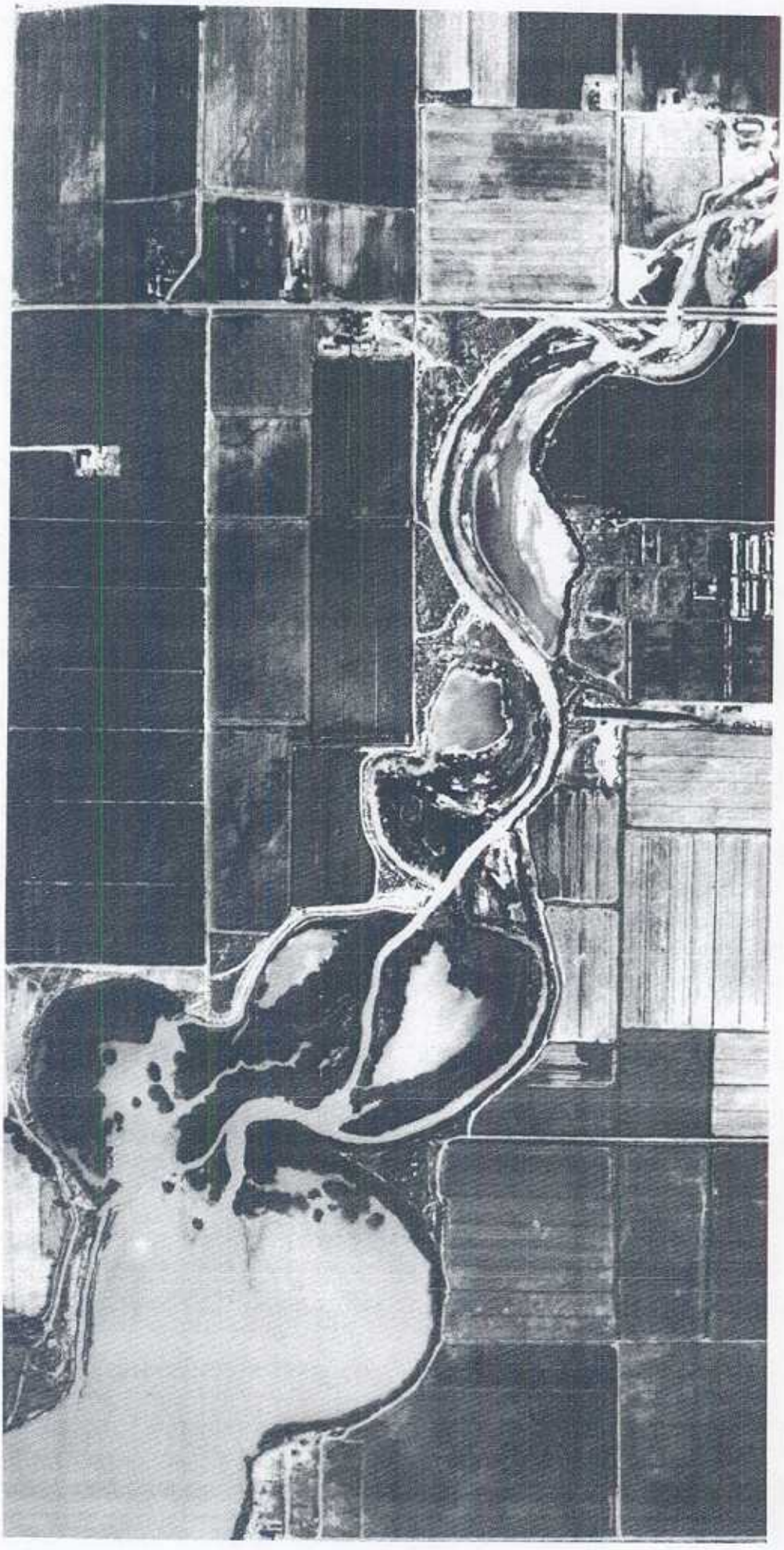

Water-Related Land Use Inventories

Utah

1993

Kanab Creek/ Virgin River Basin

UTAH
NATURAL RESOURCES
Water Resources

A WATER-RELATED LAND USE INVENTORY REPORT of the KANAB CREEK/VIRGIN RIVER BASIN (Lower Colorado River Basin)

Aerial Photography and Field Mapping
Conducted in 1990 & 1991

Prepared by

Utah Department of Natural Resources
Division of Water Resources

February 1993

ACKNOWLEDGEMENTS

This land use inventory report was conducted under the direction of Paul L. Gillette, deputy director, and supervised by Lloyd H. Austin, chief, Resources Inventories and Special Studies Section, Utah State Division of Water Resources. Staff members assisting in the preparation of this report and/or in the data collection and analyses were Jim Stephens, Eric Klotz, Anne Lewis, Jack Ralls, Lloyd Austin, Kara Hartman, Shalaine Grimshaw, Carmen McDonald, Frank Little and Jim Summers. Heidi Shlosar, United States Geological Survey, assisted in the field mapping and checking.

Appreciation is expressed to those who have provided time and effort to acquire data and information for this inventory.

D. Larry Anderson

D. Larry Anderson, Director

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SUMMARY

This Water-Related Land Use Inventory Report of the Kanab Creek/Virgin River Basin is another in a series of land use reports prepared by the Division of Water Resources from data collected under its water-related land use inventory program. The land use inventory program of the division was set up to provide data needed in the preparation of water budgets, hydrologic inventory reports and other state water planning activities. The division has collected land use data since 1966.

The water-related land use data for the Kanab Creek area were collected in 1990; Virgin River Basin data were gathered in 1991. The report displays the data by subarea (see Figures 5 through 19) and tabulates it by subarea and county in Tables 2 and 3, respectively. The tables are presented in this summary as Tables i and ii, respectively.

The division inventoried over 75,940 acres of land in the Kanab Creek/ Virgin River Basin. This represents only about 3.4 percent of the entire basin. Areas not inventoried are mainly rangeland and national forests. Of the inventoried acres, 25,603 are irrigated land (including land that is fallow or idle), 7,931 are wet/open water areas (including reservoirs), and 21,190 are residential/ industrial areas (including farmsteads and rural housing).

In conducting water-related land use inventories, the division attempts to inventory all lands or areas that consume or evaporate water other than natural precipitation. Non-irrigated agricultural lands are generally mapped if they fall within or border irrigated lands. Non-irrigated lands away from irrigated lands are often not mapped. Acres shown for this category reflect only the number of acres mapped, not the number of acres that may be in this

Table i. Summary of land cover by subarea for the Kanab Creek/Virgin River Basin (acres).

Code	Cover	Johnson Wash 10-02-001	Kanab Creek 10-02-002	Up. Lg.Valley 10-01-001	Low. Lg. Valley 10-01-002	N. Fk. Virgin 10-01-003
IA1a	Fruit	0	6	0	90	0
IA1e	Other Horticulture	0	0	0	0	0
IA2a	Grain	30	39	0	117	0
IA2a1	Corn	0	0	0	9	0
IA2b	Vegetables	0	0	0	0	0
IA2b1	Potatoes	0	0	0	0	0
IA2b2	Onions	0	0	0	0	0
IA2b3	Beans	0	0	0	0	0
IA2c	Other Row Crops	0	0	0	0	0
IA3a	Alfalfa	572	863	17	771	0
IA3b	Grass Hay	10	174	29	55	0
IA3c	Grass/Turf	0	0	0	0	0
IA3d	Pasture	550	820	284	328	891
IA4a	Fallow	0	99	0	17	0
IA4b	Idle Overgrown	1,509	117	0	28	42
IIA1a	Pasture (surf. & sub.)	0	31	0	0	115
IIA1b	Grass Hay (surf. & sub.)	0	0	0	0	0
Surface Irr. Cropland Subtotal		2,671	2,149	330	1,415	1,048
IIA2a	Sub. Irr. Pasture	0	147	0	0	0
IIA2b	Sub. Irr. Grass Hay	0	0	0	0	0
Sub. Irr. Cropland Subtotal		0	147	0	0	0
Irrigated Croplands Subtotal		2,671	2,296	330	1,415	1,048
IIB	Cattail/Bullrush Aspect	0	14	0	0	0
IIB-E	Wet/Vegetation Asp.	0	0	0	0	0
IIC	Wet Flats	0	0	0	0	0
IIE	Riparian	185	714	79	39	41
IIF	Open Water	0	4	33	17	22
IIF2	Reservoirs	74	57	0	32	165
IIF4a	Temporary Flooded	0	0	0	7	0
IIF4b	Sewage Lagoon	0	120	0	0	0
IIF4c	Evaporation Pond	0	0	0	7	0
Wet/Open Water Subtotal		259	909	112	102	228
VA	Farmsteads	91	72	4	23	14
VB	Residential	219	1,747	14	360	689
VB3	Open Spaces	0	84	6	29	18
VC	Commercial/Industrial	42	274	0	13	8
Residential/Industrial Subtotal		352	2,177	24	425	729
Land Use/Land Cover Totals		3,282	5,382	466	1,942	2,005

Table i. Continued.

Code	Cover	Virg./Spgdale 10-01-004	Hurr./La Verk 10-01-05a	Hurr./La Verk 10-01-05b	Pine Valley 10-01-006	Gunlock 10-01-007
IA1a	Fruit	38	383	0	0	26
IA1e	Other Horticulture	0	0	0	0	0
IA2a	Grain	0	224	59	0	76
IA2a1	Corn	15	13	0	0	6
IA2b	Vegetables	0	0	0	0	0
IA2b1	Potatoes	0	0	0	0	0
IA2b2	Onions	0	0	0	0	0
IA2b3	Beans	0	0	0	0	0
IA2c	Other Row Crops	0	8	0	0	0
IA3a	Alfalfa	287	1,229	62	23	389
IA3b	Grass Hay	4	114	0	212	12
IA3c	Grass/Turf	0	27	27	0	0
IA3d	Pasture	637	2,124	0	732	869
IA4a	Fallow	10	227	183	2	14
IA4b	Idle Overgrown	57	2,092	115	5	392
IIA1a	Pasture (surf. & sub.)	63	15	0	0	0
IIA1b	Grass Hay (surf. & sub.)	0	0	0	0	0
Surface Irr. Cropland Subtotal		1,111	6,456	446	974	1,784
IIA2a	Sub. Irr. Pasture	0	54	0	0	0
IIA2b	Sub. Irr. Grass Hay	0	0	0	0	0
Sub. Irr. Cropland Subtotal		0	54	0	0	0
Irrigated Croplands Subtotal		1,111	6,510	446	974	1,784
IIB	Cattail/Bullrush Aspect	0	0	0	0	0
IIB-E	Wet/Vegetation Asp.	0	0	0	0	0
IIC	Wet Flats	0	0	0	0	0
IIE	Riparian	935	572	22	60	277
IIF	Open Water	6	595	0	9	35
IIF2	Reservoirs	42	5	0	6	47
IIF4a	Temporary Flooded	0	0	0	0	0
IIF4b	Sewage Lagoon	25	21	0	0	0
IIF4c	Evaporation Pond	0	0	0	0	0
Wet/Open Water Subtotal		1,008	1,193	22	75	359
VA	Farmsteads	6	96	0	40	29
V8	Residential	697	3,370	130	230	1,015
V83	Open Spaces	56	99	0	1	4
VC	Commercial/Industrial	73	535	0	0	12
Residential/Industrial Subtotal		832	4,100	130	271	1,060
Land Use/Land Cover Totals		2,951	11,803	598	1,320	3,203

Table i. Continued.

Code	Cover	Gunlock Res. 10-01-008	Santa Clara 10-01-009	St. G/Wash. 10-01-10a	St. G/Wash. 10-01-10b	Littlefield 10-01-011	Total
IA1a	Fruit	0	102	152	0	2	799
IA1e	Other Horticulture	0	0	2	0	0	2
IA2a	Grain	0	289	86	32	0	952
IA2a1	Corn	0	7	1	18	0	69
IA2b	Vegetables	0	0	0	0	0	0
IA2b1	Potatoes	0	0	0	0	0	0
IA2b2	Onions	0	0	0	0	0	0
IA2b3	Beans	0	0	0	0	0	0
IA2c	Other Row Crops	0	98	602	17	0	725
IA3a	Alfalfa	0	368	2,082	521	34	7,218
IA3b	Grass Hay	0	41	65	14	0	730
IA3c	Grass/Turf	0	6	68	0	0	128
IA3d	Pasture	0	141	634	57	94	8,161
IA4a	Fallow	0	45	170	45	23	835
IA4b	Idle Overgrown	26	364	345	259	65	5,416
IIA1a	Pasture (surf. & sub.)	0	0	137	0	0	361
IIA1b	Grass Hay (surf. & sub.)	0	0	0	0	0	0
Surface Irr. Cropland Subtotal		26	1,461	4,344	963	218	25,396
IIA2a	Sub. Irr. Pasture	0	4	2	0	0	207
IIA2b	Sub. Irr. Grass Hay	0	0	0	0	0	0
Sub. Irr. Cropland Subtotal		0	4	2	0	0	207
Irrigated Croplands Subtotal		26	1,465	4,346	963	218	25,603
IIB	Cattail/Bullrush Aspect	0	0	9	0	0	23
IIB-E	Wet/Vegetation Asp.	0	0	0	0	0	0
IIC	Wet Flats	0	0	0	0	0	0
IIE	Riparian	47	818	1,497	195	763	6,244
IIF	Open Water	0	25	20	10	11	787
IIF2	Reservoirs	217	0	0	0	0	645
IIF4a	Temporary Flooded	0	0	0	0	0	7
IIF4b	Sewage Lagoon	0	0	49	0	0	215
IIF4c	Evaporation Pond	0	0	0	0	3	10
Wet/Open Water Subtotal		264	843	1,575	205	777	7,931
VA	Farmsteads	0	147	407	178	10	1,117
VB	Residential	0	2,365	3,332	991	1,034	16,193
VB3	Open Spaces	0	494	220	171	159	1,341
VC	Commercial/Industrial	0	448	1,018	94	22	2,539
Residential/Industrial Subtotal		0	3,454	4,977	1,434	1,225	21,190
Land Use/Land Cover Totals		290	5,762	10,898	2,602	2,220	54,724

Table ii. Summary of land cover by county for the Kanab Creek/Virgin River Basin (acres).

Code	Cover	Iron Co.	Kane Co.	Washington Co.	Total
IA1a	Fruit	0	71	728	799
IA1e	Other Horticulture	0	0	2	2
IA2a	Grain	0	126	826	952
IA2a1	Corn	0	9	60	69
IA2b	Vegetables	0	0	0	0
IA2b1	Potatoes	0	0	0	0
IA2b2	Onions	0	0	0	0
IA2b3	Beans	0	0	0	0
IA2c	Other Row Crops	0	0	725	725
IA3a	Alfalfa	255	2,195	4,768	7,218
IA3b	Grass Hay	0	268	462	730
IA3c	Grass/Turf	3	0	125	128
IA3d	Pasture	659	2,639	4,863	8,161
IA4a	Fallow	72	101	662	835
IA4b	Idle Overgrown	518	1,696	3,202	5,416
IIA1a	Pasture (surf. & sub.)	15	146	200	361
IIA1b	Grass Hay (surf. & sub.)	0	0	0	0
Surface Irr. Cropland Subtotal		1,522	7,251	16,623	25,396
IIA2a	Sub. Irr. Pasture	0	147	60	207
IIA2b	Sub. Irr. Grass Hay	0	0	0	0
Sub. Irr. Cropland Subtotal		0	147	60	207
Irrigated Croplands Subtotal		1,522	7,398	16,683	25,603
IIB	Cattail/Bullrush Aspect	0	14	9	23
IIB-E	Wet/Vegetation Asp.	0	0	0	0
IIC	Wet Flats	0	0	0	0
IIE	Riparian	0	1,058	5,186	6,244
IIF	Open Water	13	63	711	787
IIF2	Reservoirs	0	137	508	645
IIF4a	Temporary Flooded	0	7	0	7
IIF4b	Sewage Lagoon	0	120	95	215
IIF4c	Evaporation Pond	0	7	3	10
Wet/Open Water Subtotal		13	1,406	6,512	7,931
VA	Farmsteads	0	204	913	1,117
VB	Residential	264	2,340	13,589	16,193
VB3	Open Spaces	3	119	1,219	1,341
VC	Commercial/Industrial	6	337	2,196	2,539
Residential/Industrial Subtotal		273	3,000	17,917	21,190
Land Use/Land Cover Totals		1,808	11,804	41,112	54,724

category in the basin. Dry-land agriculture (grain, beans, seeds, safflowers, etc.) represents a substantial part of the total agriculture in this area of the state. The division mapped 20,443 acres under dry-land agriculture in the Kanab Creek-Virgin River Basin.

This report also discusses the Division of Water Resources' previous and present methodology of collecting and processing water-related land use data. It discusses the various land use classification codes used in past studies, and what is now considered the Standard Land Use Codes, which the division adopted in 1988 for all land use/land cover studies.

The information should be valuable to a variety of users, including county and city planners, state and federal agencies and private land owners. The division will use the data in water budget reports and in state water planning reports.

INTRODUCTION

The Division of Water Resources has been charged by the Utah State Legislature with the responsibility of developing a state water plan. This plan would coordinate and give direction to the activities of state and federal agencies concerned with Utah's water resources. To accomplish this objective, an assessment of the land use and available water resources is being made on a continuing basis. As a basis for planning and further development, the state has been divided into 11 natural drainage basins or study units shown in Figure 1. The South and East Colorado River Basin (originally designated basin No. 9) has been divided into the Southeast Colorado River Basin (retaining designation No. 9) and the Kanab Creek/Virgin River Basin (Lower Colorado River Basin), which is now basin No. 10.

While land use inventories contain information on land use in the state, water budget reports contain climate, hydrologic and general information on the water resources within specific basins or study units. The water budgets provide an accounting of water inflow, outflow, yield, storage, evaporation, transpiration and uses in the study area. Hydrologic inventories and water budget reports currently published by the division are listed in Appendix A.

A major consideration in preparing water budgets is the quantity of water depleted through evaporation and transpiration. Estimates of these depletions are obtained by preparing water budgets from data gathered in the water-related land use inventories. This data includes the kinds and extent of irrigated crops, as well as similar information on phreatophytes, wet/open water areas and residential/industrial areas.

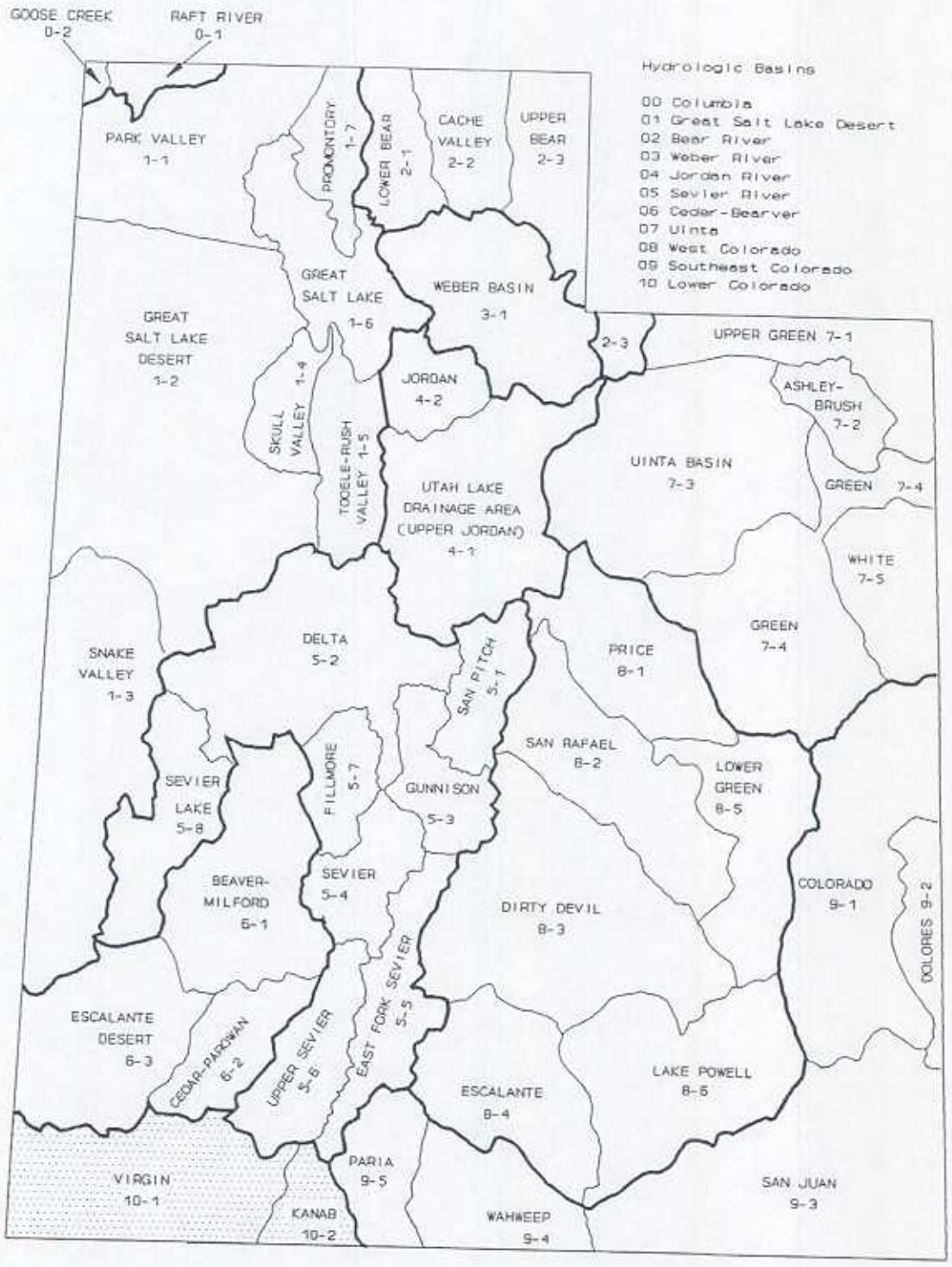

Figure 1. State of Utah hydrologic study areas with the Kanab Creek/ Virgin River Study Unit highlighted.

Since 1966 the division has conducted water-related land use and hydrologic inventories in conjunction with other state water planning activities.

This land use report should assist in promoting the coordinated and orderly development, conservation, use and management of water and land resources in the Kanab Creek/Virgin River Basin.

KANAB CREEK/VIRGIN RIVER STUDY UNIT WATER-RELATED LAND USE INVENTORY

The Kanab Creek/Virgin River Water-Related Land Use Inventory study unit was shown in Figure 1. Figure 2 shows the Kanab Creek/Virgin River Study Unit divided into separate hydrologic subareas. The study unit includes approximately 3,500 square miles of land extending from the Utah-Arizona state line and the Utah-Nevada state line, north and east to the Bull Valley and Harmony mountains on the north and the divide between Johnson Wash and Kaibab Gulch Tributaries on the east. Figure 3 shows the Kanab Creek/Virgin River Basin overlaid with a template showing the 7-1/2 min. USGS quadrangle maps used in the inventory. The state Automated Geographic Reference Center's (AGRC) reference numbers are cross-referenced with the division's reference number and the quadrangle name.

List of subarea codes and names for Figure 2.

Code	Subarea Name
10-01-001	Upper Long Valley
10-01-002	Lower Long Valley
10-01-003	North Fork Virgin
10-01-004	Virgin/Springdale
10-01-05a	Hurricane/La Verkin subarea A
10-01-05b	Hurricane/La Verkin subarea B
10-01-006	Pine Valley
10-01-007	Gunlock
10-01-008	Gunlock Reservoir
10-01-009	Santa Clara
10-01-10a	St. George/Washington subarea A
10-01-10b	St. George/Washington subarea B
10-01-011	Littlefield
10-02-001	Johnson Wash
10-02-002	Kanab Creek

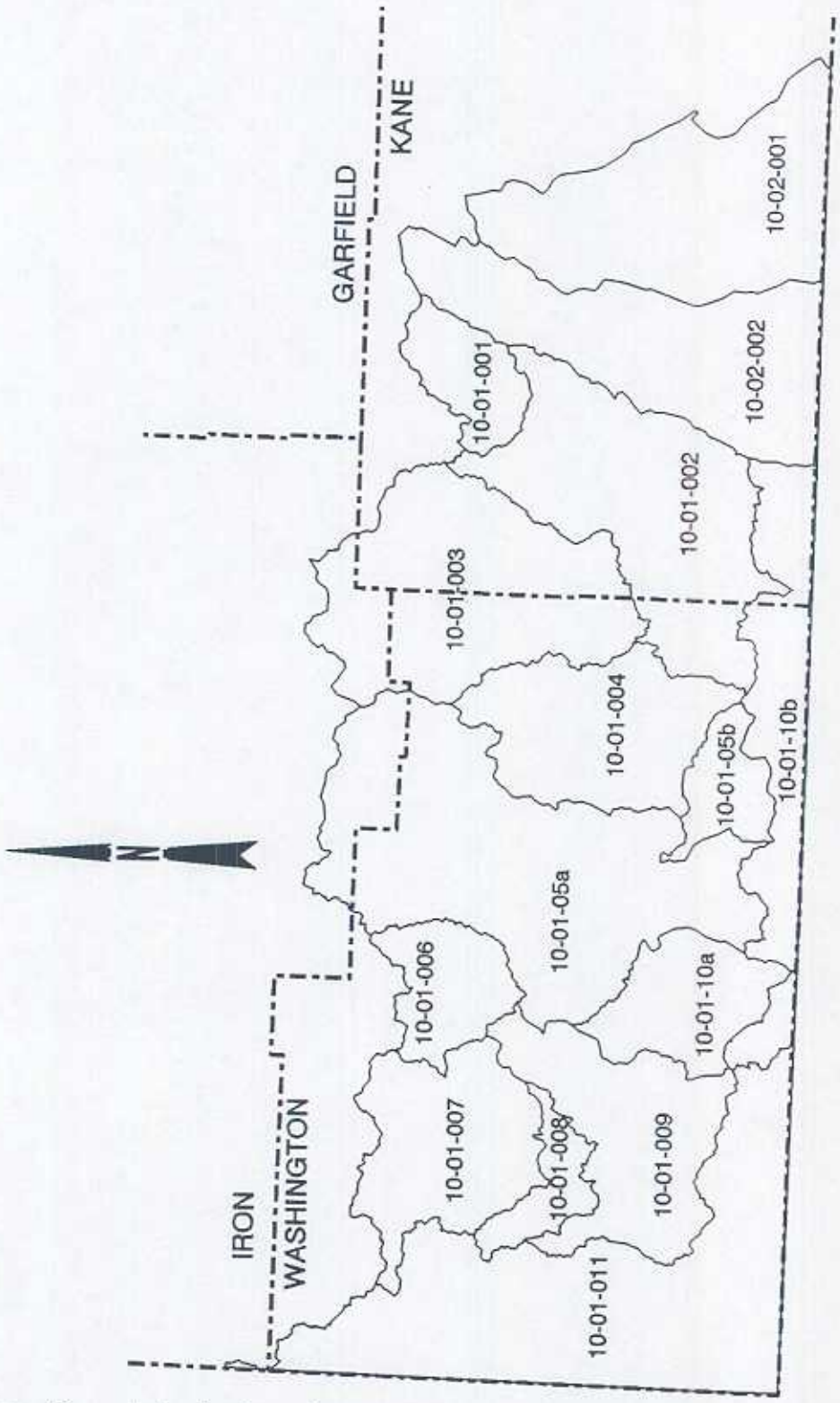

Figure 2. Hydrologic subareas of the Kanab Creek/Virgin River drainage area.

List of 7-1/2 Minute Quadrangles by Name for Figure 3.

List No.	Quadrangle Name	AGRC No.	DWR No.	List No.	Quadrangle Name	AGRC No.	DWR No.
1.	Pine Peak	3802	525a	37.	Orderville	4013	T43
2.	Water Canyon	3803	525	38.	Glendale	4014	T44
3.	Hebron	3804	526	39.	Bald Knoll	4015	T45
4.	Enterprise	3805	527	40.	Skutumpa Creek	4016	T46
5.	Page Ranch	3807	529	41.	Scarecrow Peak	4102	549a
6.	Stoddard Mtn.	3808	530	42.	West Mountain Peak	4103	549
7.	Kanarraville	3809	531	43.	Shivwits	4104	550
8.	Cedar Mountain	3810	532	44.	Santa Clara	4105	551
9.	Webster Flat	3811	T25	45.	Washington	4106	552
10.	Navajo Lake	3812	T26	46.	Harrisburg Junction	4107	553
11.	Docs Pass	3902	533a	47.	Hurricane	4108	554
12.	Gold Strike	3903	533	48.	Virgin	4109	555
13.	Maple Ridge	3904	534	49.	Springdale West	4110	556
14.	Central West Central	3905	535	50.	Springdale East	4111	T49
15.	East	3906	536	51.	The Barracks	4112	T50
16.	Grass Valley	3907	537	52.	Mount Carmel	4113	T51
17.	New Harmony	3908	538	53.	White Tower	4114	T52
18.	Kolob Arch	3909	539	54.	Cutler Point	4115	T53
19.	Kolob Reservoir	3910	540	55.	Pine Point	4116	T54
20.	Cogswell Point	3911	T33	56.	Nephi Point	4117	T55
21.	Straight Canyon	3912	T34	57.	Terry Benches	4202	557a
22.	Strawberry Point	3913	T35	58.	Castle Cliff	4203	557
23.	Long Valley Junction	3914	T36	59.	Jarvis Peak	4204	558
24.	Alton	3915	T37	60.	White Hills	4205	559
25.	Podunk Creek	3916	T38	61.	St. George	4206	560
26.	Dodge Springs	4002	541a	62.	Washington Dome	4207	561
27.	Motoqua	4003	541	63.	The Divide	4208	562
28.	Gunlock	4004	542	64.	Little Creek Mtn.	4209	563
29.	Veyo	4005	543	65.	Smithsonian Butte	4210	564
30.	Saddle Mountain	4006	544	66.	Hilldale	4211	T57
31.	Signal Peak	4007	545	67.	Elephant Butte	4212	T58
32.	Pintura	4008	546	68.	Yellow Jacket Canyon	4213	T59
33.	Smith Mesa	4009	547	69.	Kanab	4214	T60
34.	The Guardian Angels	4010	548	70.	Thompson Point	4215	T61
35.	Temple Sinawava	4011	T41	71.	Johnson Lakes	4216	T62
36.	Clear Creek Mtn.	4012	T42	72.	Petrified Hollow	4217	T63

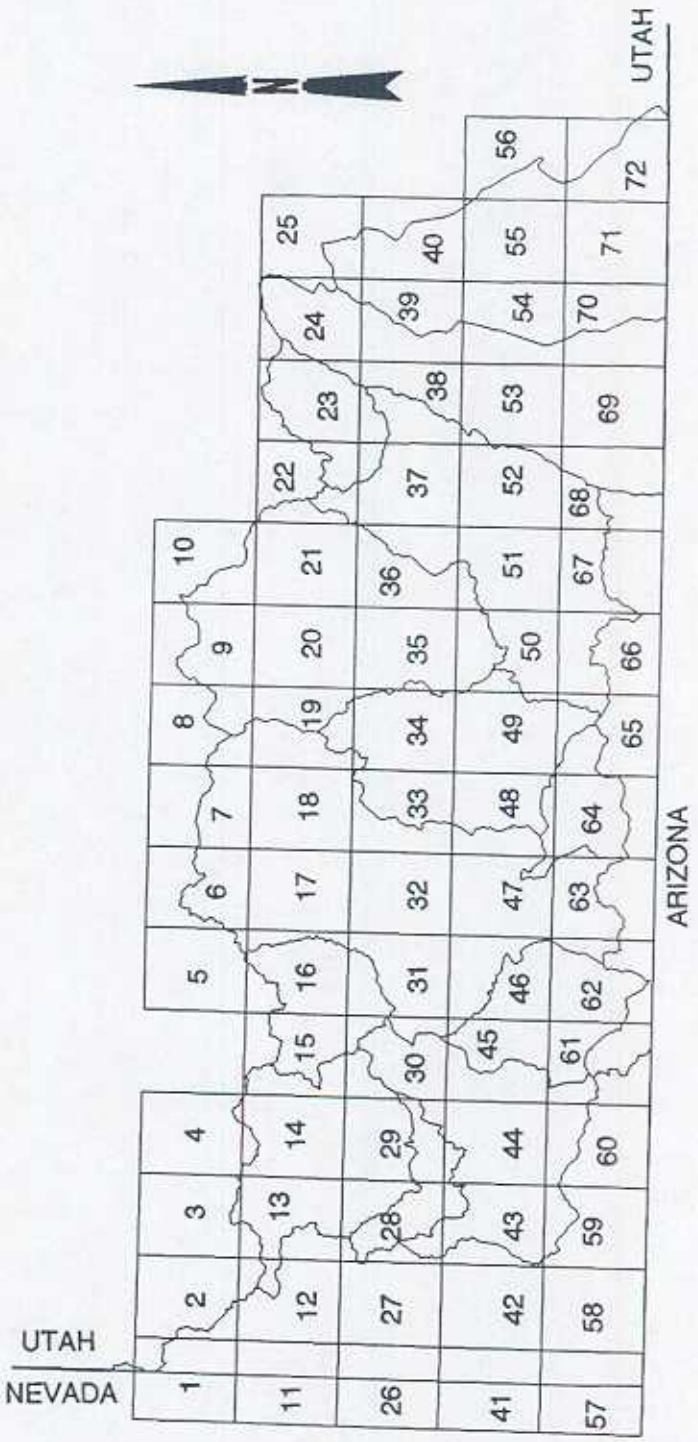

Figure 3. Kanab Creek/Virgin River Basin with hydrologic study area boundaries, overlaid by a template showing 7-1/2 min. USGS quadrangle maps.

OPERATIONS USED IN LAND USE DATA ACQUISITION

Aerial Photography

Aerial photography of the study area was conducted from June to August 1990 for the Kanab Creek Study Area and from June to August 1991 for the Virgin River Study Area. Mapping & Analytical Photographic Services Inc., Salt Lake City, Utah, photographed the study area using a turbo-charged Cessna TU-206 aircraft specially modified for aerial photography. An ARNAV R-40 Loran C navigation system kept the plane on line, while a Nikon F-3 35mm camera with 24mm lens in the photo well took the photos. All slides were taken on 35mm Ektachrome film and processed by Kodak labs. Slides were identified according to flight line number, cross-referenced on a special location map, and delivered to the division at different times between June and August each year. The actual flight date was written on each slide frame by the division. Approximately 810 slides were delivered to the division covering the water-related land use in the study unit. These slides may be viewed at, or copies purchased from, the offices of the Division of Water Resources, Planning Section, 1636 West North Temple, Salt Lake City, Utah.

Field Mapping and Checking

Transferring information from 35mm slides to the field maps was accomplished between June and August of each year. Slide cataloging, filing and mapping were done concurrently. Field checking and mapping was completed during July and August for each year. This process involved nine people from the Division of Water Resources and one from the U.S. Geological Survey.

Digitizing and Processing

The data resulting from digitizing the field maps were processed through the Utah State Automated Geographic Reference Center (AGRC) during the falls and winters of 1990 and 1991. The Kanab Creek/Virgin River data are maintained at both the AGRC and the Division of Water Resources. Maps and data can be obtained from the AGRC at the Office of Planning and Budget, State Office Building, Salt Lake City, Utah.

A draft map of the cropland cover types was printed for each 7-1/2 min. quad. map for the purpose of checking the data. Each map was laid over the corresponding field map on a light table, and the cropland types and boundaries were double-checked for accuracy. Any corrections or additions were marked in red on the draft map for future updating. The corrected maps were updated and stored on the AGRC system.

KANAB CREEK/VIRGIN RIVER LAND USE DATA

The list of cover types and codes used in the 1990-91 Water-Related Land Use Inventory for the Kanab Creek/Virgin River Basin is shown in Table 1. This list, standardized in 1988, is further discussed in the land use categories of this report. Figure 4 shows the general location of the water-related land use areas mapped in the Kanab Creek/Virgin River Study Unit. Figures 5-19 show the water-related land use for each hydrologic subarea. The explanation opposite each of these figures shows the land cover categories and the number of acres of land in each category.

Division policy is to publish its land use data in these types of reports: detailed maps, however, will not be included. With the establishment of the Automated Geographic Reference Center (AGRC) for the state of Utah, the division policy is to supply the land use data to the center for further distribution. Detailed maps can be obtained from the AGRC.

Table 1. List of cover types and codes used in the 1990-91 Water-Related Land Use Inventory for the Kanab Creek/Virgin River Basin.

Code	Cover Type	Comments/Explanations
I	Cropland	(Rotation Crops)
IA	Irrigated Cropland	
IA1	Horticulture & Specialty Crops	
IA1a	Fruit	(Orchards)
IA1a1	Cherry	
IA1a2	Apple	
IA1a3	Peach	
IA1a4	Pear	
IA1a5	Apricot	
IA1a6	Other	
IA1b	Nuts	(Groves)
IA1b1	Walnut	
IA1b2	Pecan	
IA1b3	Other	
IA1c	Vineyard	(Grapes)
IA1d	Bush Fruit	
IA1e	Berries	
IA1f	Other Horticulture	(Nurseries)
IA1g	Other Specialty Crops	
IA2	Row and Close Grown Crops	
IA2a	Grain	
IA2a1	Corn	
IA2a2	Sorghum	
IA2a3	Wheat	
IA2a4	Barley	
IA2a5	Oats	
IA2a6	Other Grains	
IA2b	Vegetables	
IA2b1	Potatoes	
IA2b2	Onions	
IA2b3	Beans	
IA2b4	Tomatoes	
IA2b5	Sweet Corn	
IA2b6	Other	(Melons, Squash, Etc.)

Table 1. Continued.

Code	Cover Type	Comments/Explanations
IA3	Forage Crops	
IA3a	Alfalfa	
IA3b	Grass Hay	
IA3c	Grass/Turf	
IA3d	Pasture	
IA3e	Other	(Turf Farms)
IA4	Other	
IA4a	Fallow	(Plowed or disked.)
IA4b	Idle	(Overgrown more than one season.)
IB	Non-Irrigated Cropland	(Rotation Crops)
IB1	Row and Close-Grown Crops	
IB1a	Grain, Beans, Seeds	
IB1a1	Wheat	
IB1a2	Other Grains	(Barley, Etc.)
IB1a3	Dry Beans	
IB1a4	Safflower	
IB1a5	Other	
IB2	Hayland Crops	
IB2a	Alfalfa	
IB2b	Pasture	
IB2c	Other	
IB3	Other	
IB3a	Fallow	(Plowed, Stubble, Mulch)
IB3b	Idle	(Overgrown more than one season.)
II	Grassy/Phreato./Open Water Areas	
IIA	Grassy Aspect	
IIA2a	Irrigated	
IIA2a1	Pasture	(Subject to spring flooding.)
IIA2a2	Hayland	(Subject to spring flooding.)
IIA2b	Non-Irrigated	
IIA2b1	Pasture	(Receives subsurface water.)
IIA2b2	Hayland	(Receives subsurface water.)
IIA2c	Non-Agricultural Use	(Receives subsurface water.)
IIB	Cattail/Bullrush Aspect	

Table 1. Continued.

Code	Cover Type	Comments/Recommendations
IIC	Wet Flats	(Mud flats w/little or no vgttn.)
IID	Shrub Aspect	(Salt Brush, Sagebrush)
IIE	Riparian	
IIE1	Forested Aspect	(Cottonwoods, Birch)
IIE2	Shrub Aspect	(Willows)
IIF	Open Water	
IIF1	Streams	
IIF2	Reservoirs	(Man-Made)
IIF3	Ponds & Lakes	
IIF4	Other	
IIF4a	Temporary Flooded	
IIF4b	Sewage Lagoon	
IIF4c	Evaporation Pond	
III	Rangeland and Forestland	
IIIA	Alpine Plant Communities	
IIIB	Conifer	
IIIB1	Douglas Fir - White Fir	
IIIB2	Ponderosa Pine	
IIIB3	Fir - Spruce	
IIIB4	Lodgepole Pine	
IIIB5	Pinion Pine - Juniper	
IIIB6	Other	
IIIC	Deciduous	
IIIC1	Aspen	
IIIC2	Mountain Brush	(Oak Brush, Maples, Chaparral)
IIIC3	Other	
IIID	Grass Aspect	
IIID1	Dry Pastures - Improved	(Chained and reseeded.)
IIID2	Native Grasses	
IIID3	Other	(Forbs)
IIIE	Shrub Aspect	
IIIE1	Northern Desert Shrub	
IIIE1a	Sagebrush	(Shadscale, Greasewood, Halogeton)s

Table 1. Continued.

Code	Cover Type	Comments/Explanations
IIIE1b	Other	
IIIE2	Southern Desert Shrubs	
IIIE2a	Creosote Bush	
IIIE2b	Other	(Forbs, Annual Grasses)
IIIE3	Salt Desert Shrubs	
IIIE3a	Shascale	
IIIE3b	Greasewood	
IIIE3c	Saltbrush	
IIIE3d	Desert Molley	
IIIE3e	Other	(Halogeton)
IV	Barren Lands	
IVA	Bare Soil/Sand	
IVA1	Dry Salt Flats	
IVA2	Beaches	
IVA3	Sandy Areas Other Than Beaches	
IVA4	Other	(Desert Sand Dunes)
IVB	Rock Outcrops	
IVC	Excavated Lands	(Strip Mines, Quarries, Gravel Pits)
IVD	Other	
V	Built-Up Land	
VA	Farmsteads	
VA1	Buildings/Homes	
VA2	Open Spaces	(Feed Lots, Etc.)
VB	Residential	
VB1	Buildings/Homes	(High Density)
VB2	Buildings/Homes	(Low Density)
VB3	Open Spaces	(Parks, Golf Courses)
VB4	Idle Spaces	(Not Irrigated)
VC	Commercial/Industr8ial	
VC1	Commercial	
VC2	Industrial	
VC3	Open Spaces	
VD	Transportation, Communications, Utilities	
VE	Other	

Land Cover Area Summary for Figure 4.

State Code	Cover Type	Acres
IA1a	Fruit	799.67
IA1c	Vineyard	2.14
IA2a	Grain	951.89
IA2a1	Corn	69.94
IA2a2	Sorghum	25.02
IA2c	Other Row Crops	699.73
IA3a	Alfalfa	7,216.67
IA3b	Grass Hay	731.26
IA3c	Grass/Turf	127.83
IA3d	Pasture	8,162.85
IA4a	Fallow	834.46
IA4b	Idle	5,421.24
IB1a	Grain/Beans/Seeds (n.i.)	550.66[1]
IB2a	Alfalfa (non-irr.)	10.38[1]
IB2b	Pasture (non-irr.)	11,231.76[1]
IB3a	Fallow (non-irr.)	2,613.73[1]
IB3b	Idle (non-irr.)	6,036.88[1]
IIA1a	Pasture (surf & sub-irr.)	361.82
IIA2a	Pasture (sub-irr.)	207.38
IIB	Cattail/Bullrush Asp	22.23
IIE	Riparian	6,243.47
IIF	Open Water	758.78
IIF2	Reservoirs	644.51
IIF3	Ponds & Lakes	27.80
IIF4a	Temporary Flooded	6.53
IIF4b	Sewage Lagoon	216.00
IIF4c	Evaporation Pond	10.05
IVC	Excavated Lands	757.03
VA	Farmsteads	2.58
VA1	Bldgs/Homes (rural)	225.88
VA2	Open Spaces	889.70
VB1	Bldgs/Homes (hi den)	1,791.32
VB2	Bldgs/Homes (lo den)	10,618.12
VB3	Open Spaces	1,340.62
VB4	Idle Spaces	3,781.06
VC1	Commercial	1,878.31
VC2	Industrial	242.10
VC3	Open Space	420.38
VD	Trans./Commun./Util.	9.37
		75,941.15

[1]In conducting water-related land use inventories, the division attempts to inventory all lands or areas that consume or evaporate water other than natural precipitation. Non-irrigated agriculture lands are generally mapped if they fall within or border irrigated lands. Non-irrigated lands away from irrigated lands are normally not mapped. Acres shown in the table reflect only the numbers of acres mapped, not the total numbers of acres in the subarea.

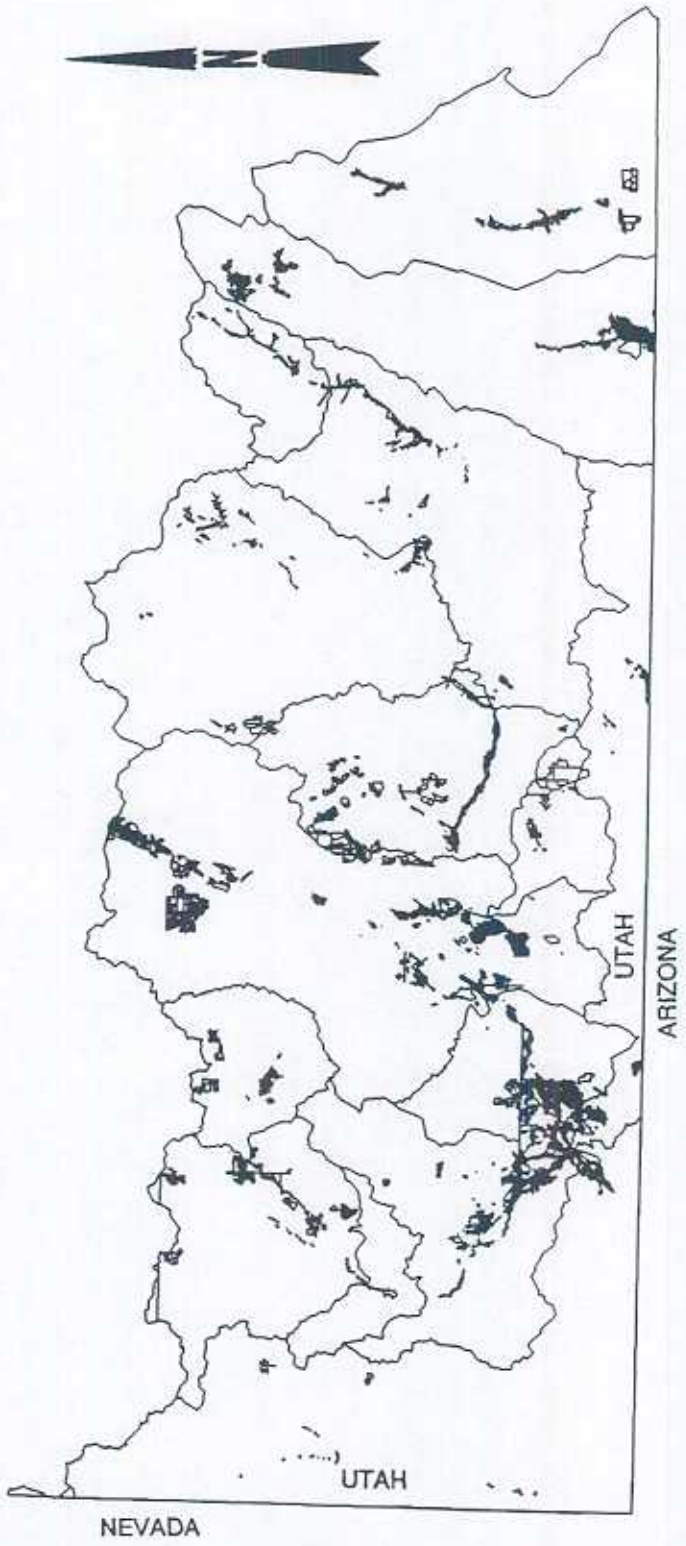

Figure 4. Water-related land use mapped areas for the Kanab Creek/ Virgin River Basin.

Land Cover Area Summary for Figure 5.
Johnson Wash Subarea

State Code	Cover Type	Acres
IA2a	Grain	29.81
IA3a	Alfalfa	571.96
IA3b	Grass Hay	10.32
IA3d	Pasture	550.49
IA4b	Idle	1,508.66
IB2b	Pasture (non-irr.)	295.92[1]
IB3b	Idle (non-irr.)	235.14[1]
IIE	Riparian	184.79
IIF2	Reservoirs	73.53
IVC	Excavated Lands	9.65
VA1	Bldgs/Homes (rural)	68.30
VA2	Open Spaces	22.58
VB2	Bldgs/Homes (lo den)	218.53
VC1	Commercial	23.13
VC2	Industrial	1.55
VVC3	Open Space	17.35
		3,821.71

[1]In conducting water-related land use inventories, the division attempts to inventory all lands or areas that consume or evaporate water other than natural precipitation. Non-irrigated agriculture lands are generally mapped if they fall within or border irrigated lands. Non-irrigated lands away from irrigated lands are normally not mapped. Acres shown in the table reflect only the numbers of acres mapped, not the total numbers of acres in the subarea.

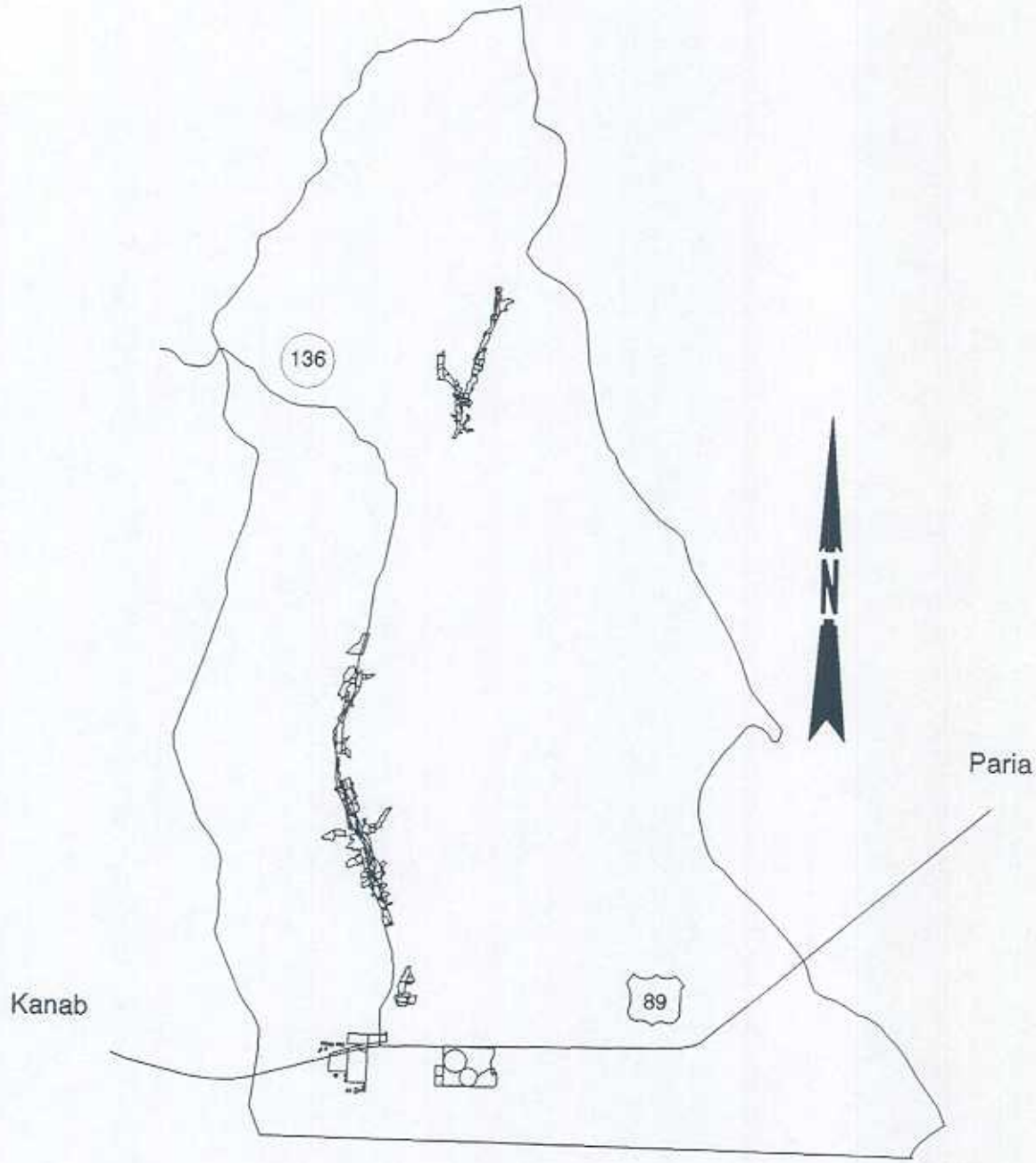

Figure 5. Water-related land use coverage for the Johnson Wash subarea (10-02-001).

Land Cover Area Summary for Figure 6.
Kanab Creek Subarea

State Code	Cover Type	Acres
IA1a	Fruit	6.31
IA2a	Grain	39.25
IA3a	Alfalfa	862.61
IA3b	Grass Hay	174.43
IA3d	Pasture	819.69
IA4a	Fallow	98.96
IA4b	Idle	117.01
IB2b	Pasture (non-irr.)	816.04[1]
IB3b	Idle (non-irr.)	18.11[1]
IIA1a	Pasture	31.46
IIA2a	Pasture	147.19
IIB	Cattail/Bullrush Asp	13.55
IIE	Riparian	714.46
IIF	Open Water	3.82
IIF2	Reservoirs	57.00
IIF4b	Sewage Lagoon	120.46
IVC	Excavated Lands	36.67
VA1	Bldgs/Homes (rural)	23.62
VA2	Open Spaces	48.18
VB2	Bldgs/Homes (lo den)	754.10
VB3	Open Spaces	84.02
VB4	Idle Spaces	992.54
VC1	Commercial	105.26
VC2	Industrial	38.15
VC3	Open Space	130.70
		6,253.59

[1]In conducting water-related land use inventories, the division attempts to inventory all lands or areas that consume or evaporate water other than natural precipitation. Non-irrigated agriculture lands are generally mapped if they fall within or border irrigated lands. Non-irrigated lands away from irrigated lands are normally not mapped. Acres shown in the table reflect only the numbers of acres mapped, not the total numbers of acres in the subarea.

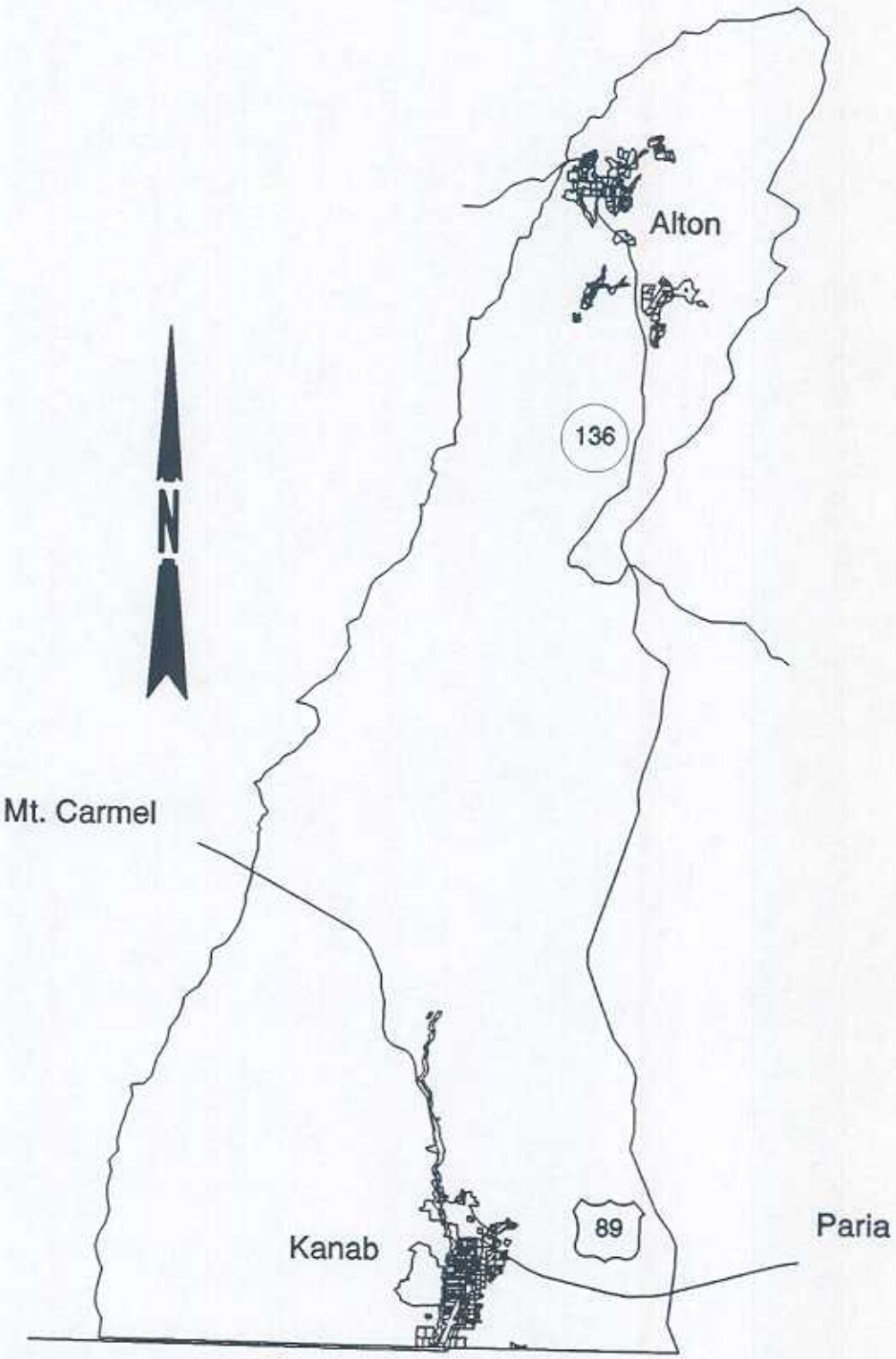

Figure 6. Water-related land use coverage of Kanab Creek subarea (10-02-002).

Land Cover Area Summary for Figure 7.
Upper Long Valley Subarea

State Code	Cover Type	Acres
IA3a	Alfalfa	16.65
IA3b	Grass Hay	29.17
IA3d	Pasture	284.43
IB2b	Pasture (non-irr.)	719.21[1]
IIE	Riparian	79.18
IIF	Open Water	32.91
VA1	Bldgs/Homes (rural)	1.99
VA2	Open Spaces	2.25
VB2	Bldgs/Homes (lo den)	14.13
VB3	Open Spaces	6.21
		1,186.13

[1]In conducting water-related land use inventories, the division attempts to inventory all lands or areas that consume or evaporate water other than natural precipitation. Non-irrigated agriculture lands are generally mapped if they fall within or border irrigated lands. Non-irrigated lands away from irrigated lands are normally not mapped. Acres shown in the table reflect only the numbers of acres mapped, not the total numbers of acres in the subarea.

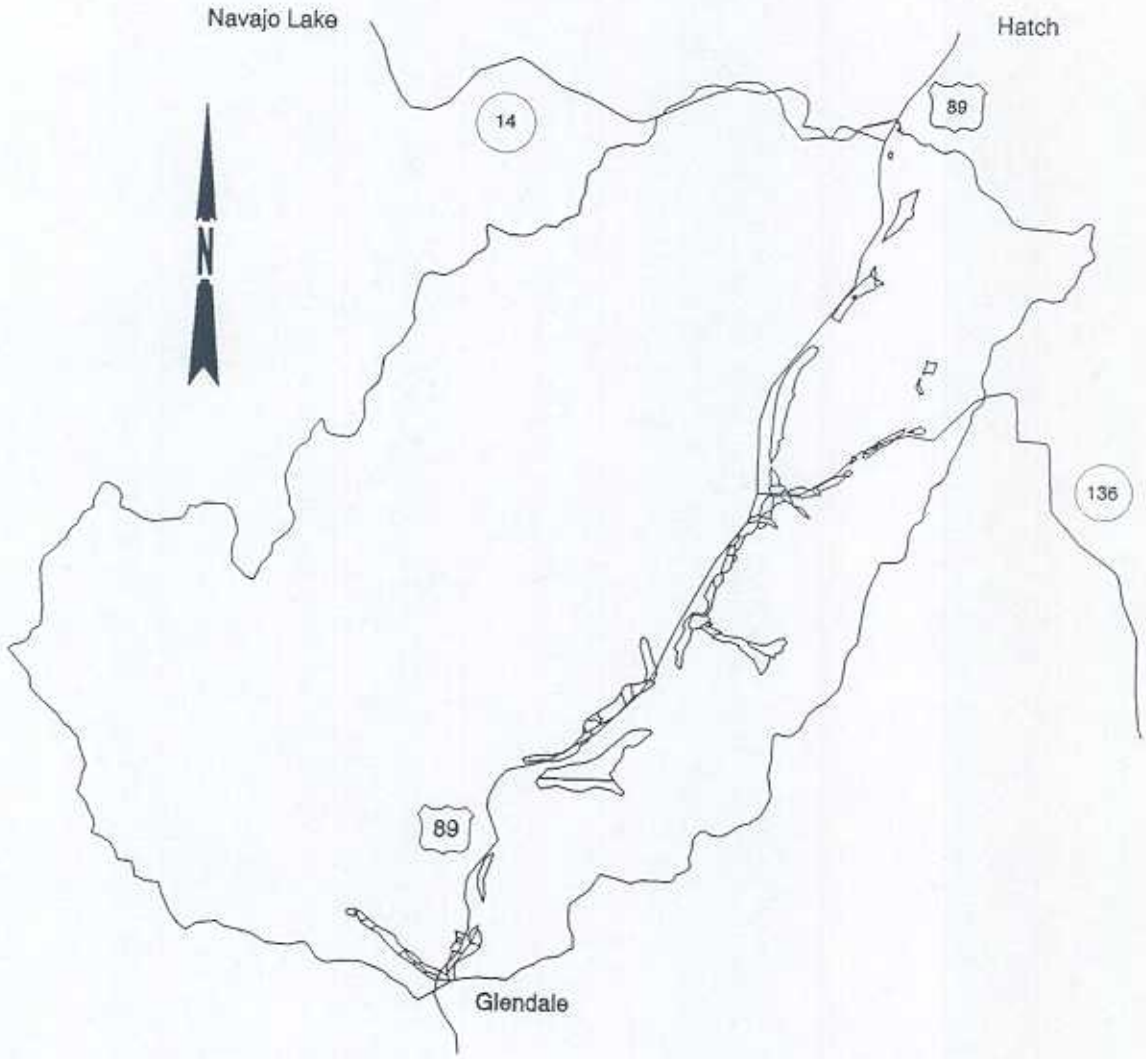

Figure 7. Water-related land use coverage of Upper Long Valley subarea (10-01-001).

Land Cover Area Summary for Figure 8.
Lower Long Valley Subarea

State Code	Cover Type	Kane County Acres	Washington Co. Acres	Total Acres
IA1a	Fruit	65.16	24.82	89.98
IA2a	Grain	57.45	59.98	117.43
IA2a1	Corn	8.86	0.00	8.86
IA3a	Alfalfa	743.35	28.25	771.60
IA3b	Grass Hay	55.26	0.00	55.26
IA3d	Pasture	311.48	17.12	328.60
IA4a	Fallow	2.46	15.17	17.63
IA4b	Idle	27.65	0.00	27.65
IB2b	Pasture (non-irr.)	399.08	0.00	399.08[1]
IB3a	Fallow (non-irr.)	73.79	0.00	73.79[1]
IB3b	Idle (non-irr.)	144.99	0.00	144.99[1]
IIE	Riparian	38.83	0.00	38.83
IIF	Open Water	7.37	0.00	17.37
IIF2	Reservoirs	0.00	31.68	31.68
IIF4a	Temporary Flooded	6.53	0.00	6.53
IIF4c	Evaporation Pond	7.33	0.00	7.33
IVC	Excavated Lands	26.44	0.00	26.44
VA1	Bldgs/Homes (rural)	6.47	0.00	6.47
VA2	Open Spaces	16.98	0.00	16.98
VB2	Bldgs/Homes (lo den)	360.08	0.00	360.08
VB3	Open Spaces	29.11	0.00	29.11
VC1	Commercial	13.14	0.00	13.14
		2,411.81	177.02	2,588.83

[1]In conducting water-related land use inventories, the division attempts to inventory all lands or areas that consume or evaporate water other than natural precipitation. Non-irrigated agriculture lands are generally mapped if they fall within or border irrigated lands. Non-irrigated lands away from irrigated lands are normally not mapped. Acres shown in the table reflect only the numbers of acres mapped, not the total numbers of acres in the subarea.

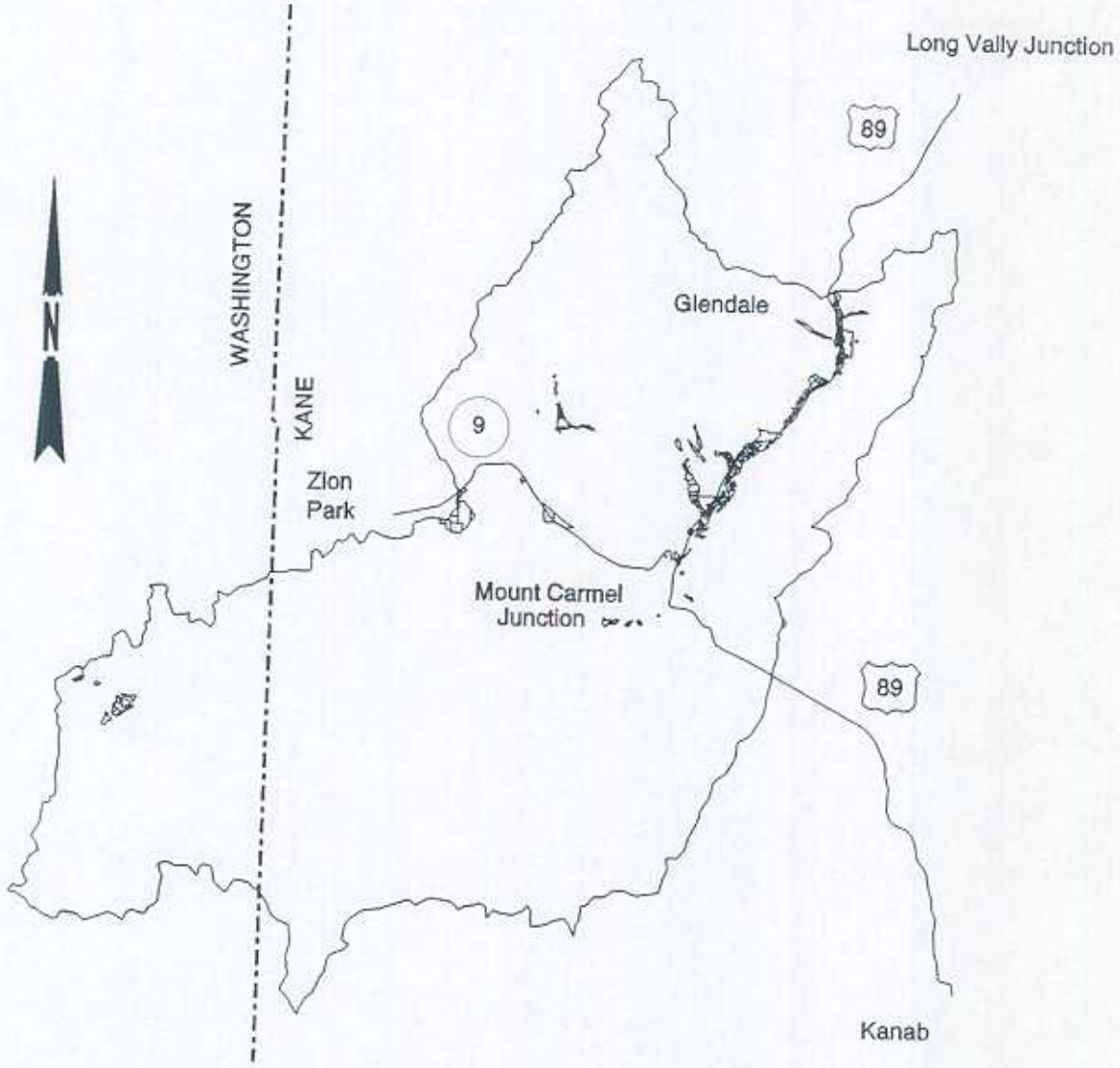

Figure 8. Water-related land use coverage of Lower Long Valley subarea (10-01-002).

Land Cover Area Summary for Figure 9.
North Fork Virgin Subarea

State Code	Cover Type	Iron Co. Acres	Kane Co. Acres	Wash. Co. Acres	Total Acres
IA3d	Pasture	31.69	674.00	184.93	890.62
IA4b	Idle	0.00	41.89	0.00	41.89
IB2b	Pasture (non-irr.)	0.00	502.70	72.29	574.99[1]
IB3b	Idle (non-irr.)	0.00	103.55	0.00	103.55[1]
IIA1a	Pasture (surf. & sub. irr.)	0.00	114.88	0.00	114.88
IIE	Riparian	0.00	41.05	0.00	41.05
IIF	Open Water	12.51	9.46	0.00	21.97
IIF2	Reservoirs	0.00	6.19	158.76	164.95
VA1	Bldg/Homes (rural)	0.00	1.05	0.00	1.05
VA2	Open Spaces	0.0	12.88	0.00	12.88
VB2	Bldgs/Homes (lo den)	21.31	0.00	67.51	88.82
VB3	Open Spaces	0.00	0.00	17.51	17.51
VB4	Idle Spaces	0.00	0.00	600.87	600.87
VC1	Commercial	0.00	8.48	0.00	8.48
VD	Trans./Commun./Util.	0.00	9.37	0.00	9.37
		65.51	1,525.50	1,101.87	2,692.88

[1]In conducting water-related land use inventories, the division attempts to inventory all lands or areas that consume or evaporate water other than natural precipitation. Non-irrigated agriculture lands are generally mapped if they fall within or border irrigated lands. Non-irrigated lands away from irrigated lands are normally not mapped. Acres shown in the table reflect only the numbers of acres mapped, not the total numbers of acres in the subarea.

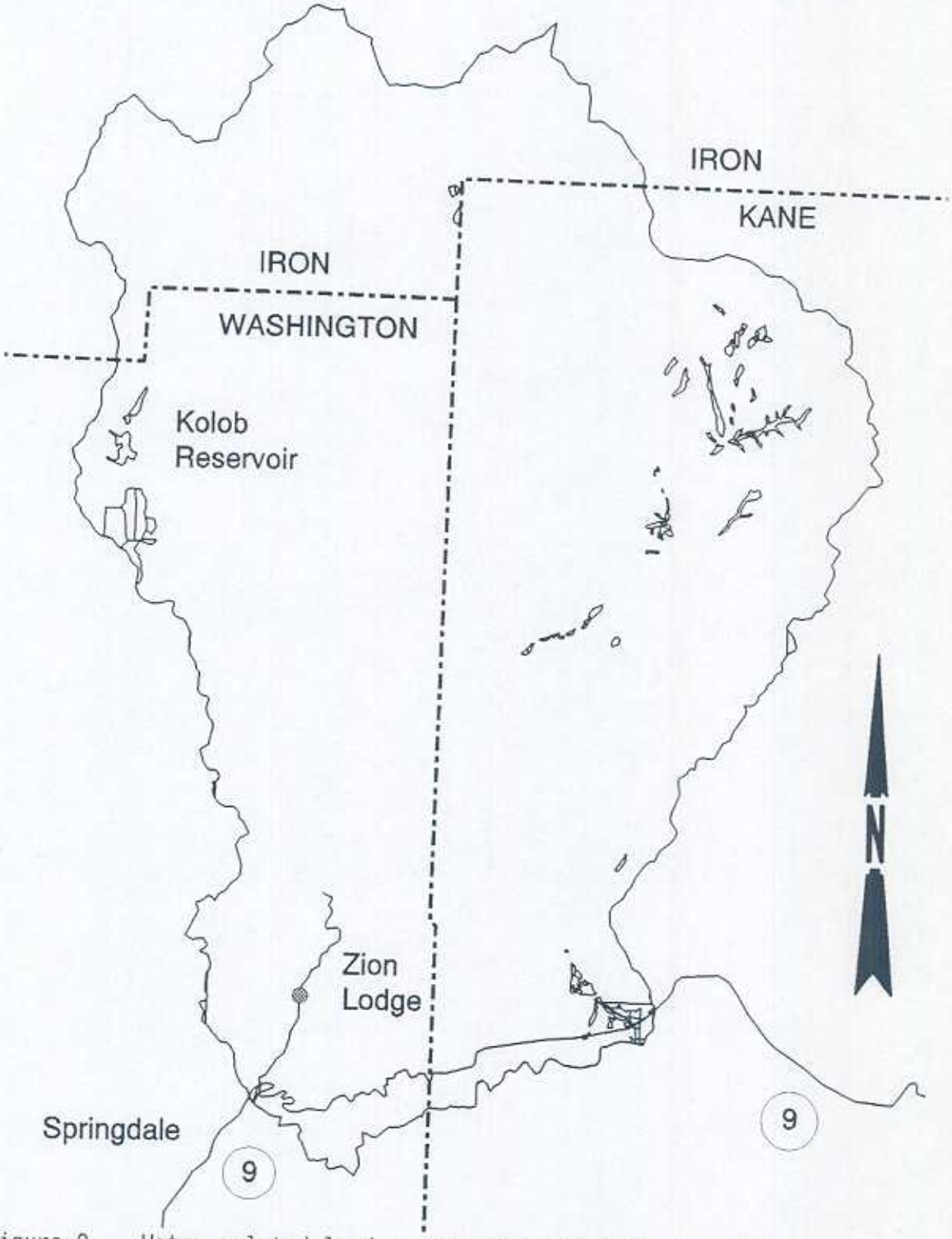

Figure 9. Water-related land use coverage of North Fork Virgin River subarea (10-01-003).

Land Cover Area Summary for Figure 10.
Virgin/Springdale Subarea

State Code	Cover Type	Acres
IA1a	Fruit	38.29
IA2a1	Corn	14.69
IA3a	Alfalfa	286.62
IA3b	Grass Hay	4.47
IA3d	Pasture	636.54
IA4a	Fallow	10.31
IA4b	Idle	56.84
IB1a	Grain/Beans/Seeds (n.i.)	550.66[1]
IB2b	Pasture (non-irr.)	1,331.32[1]
IB3a	Fallow (non-irr.)	1,366.10[1]
IB3b	Idle (non-irr.)	2,882.16[1]
IIA1a	Pasture	62.98
IIE	Riparian	934.77
IIF	Open Water	5.88
IIF2	Reservoirs	42.39
IIF4b	Sewage Lagoon	24.91
IVC	Excavated Lands	6.26
VA1	Bldgs/Homes (rural)	6.49
VB2	Bldgs/Homes (lo den)	519.73
VB3	Open Spaces	55.69
VB4	Idle Spaces	177.00
VC1	Commercial	72.58
		9,086.68

[1]In conducting water-related land use inventories, the division attempts to inventory all lands or areas that consume or evaporate water other than natural precipitation. Non-irrigated agriculture lands are generally mapped if they fall within or border irrigated lands. Non-irrigated lands away from irrigated lands are normally not mapped. Acres shown in the table reflect only the numbers of acres mapped, not the total numbers of acres in the subarea.

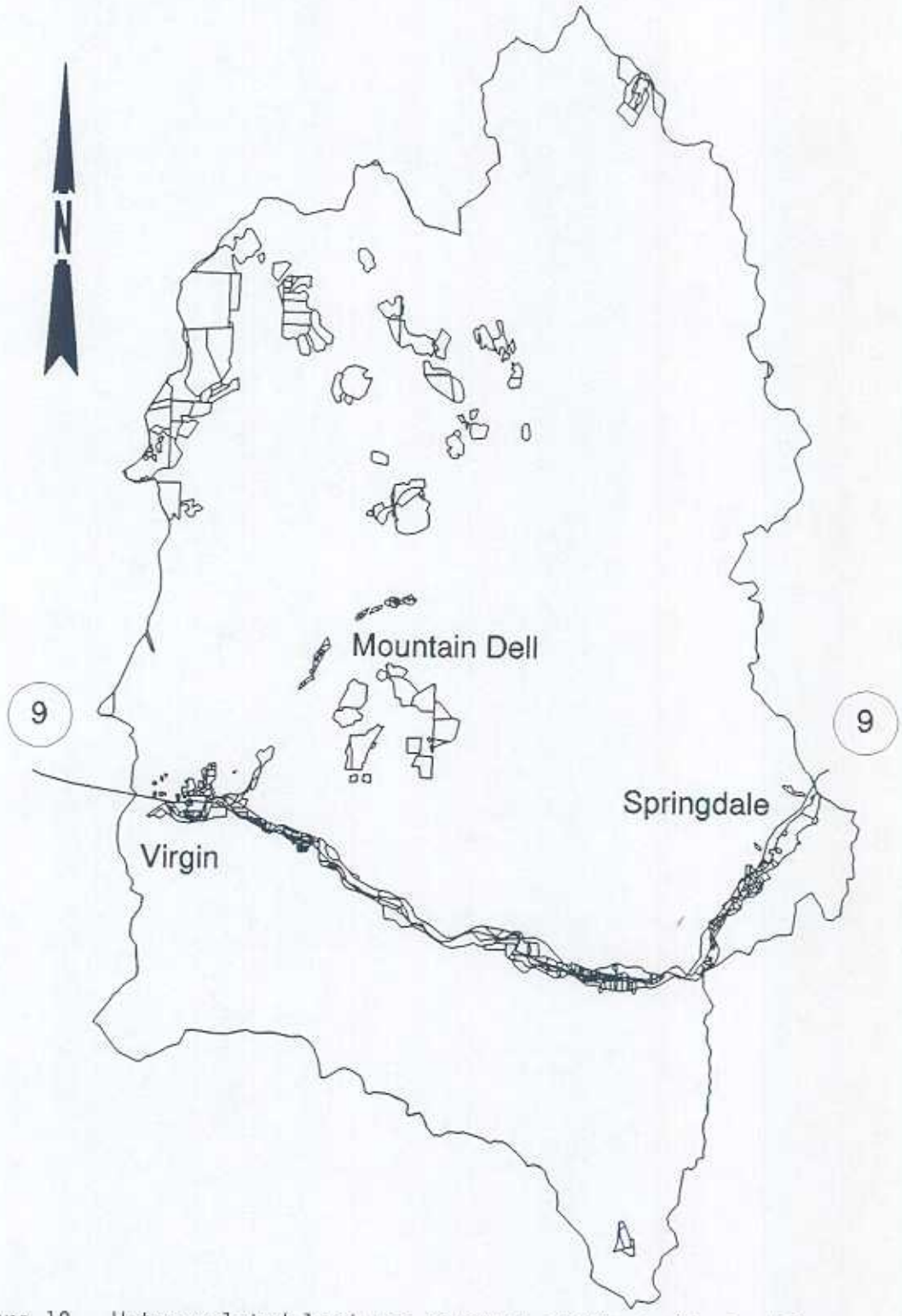

Figure 10. Water-related land use coverage of Virgin/Springdale subarea (10-01-004).

Land Cover Area Summary for Figure 11.
Hurricane/LaVerkin Subarea A

State Code	Cover Type	Iron County Acres	Washington Co. Acres	Total Acres
IA1a	Fruit	0.00	382.86	382.86
IA2a	Grain	0.00	224.08	224.08
IA2a1	Corn	0.00	13.26	13.26
IA2c	Other Row Crops	0.00	8.36	8.36
IA3a	Alfalfa	254.57	973.70	1,228.27
IA3b	Grass Hay	0.00	113.50	113.50
IA3c	Grass/Turf	3.09	23.73	26.82
IA3d	Pasture	627.38	1,496.59	2,123.97
IA4a	Fallow	71.58	154.73	226.31
IA4b	Idle	518.15	1,573.72	2,091.87
IB2a	Alfalfa (non-irr.)	10.38	0.00	10.38[1]
IB2b	Pasture (non-irr.)	822.85	2,525.07	3,347.92[1]
IB3a	Fallow (non-irr.)	271.19	528.07	799.26[1]
IB3b	Idle (non-irr.)	357.54	1,644.81	2,002.35[1]
IIA1a	Pasture (surf & sub-irr.)	15.08	0.00	15.08
IIA2a	Pasture (sub-irr.)	0.00	53.93	53.93
IIE	Riparian	0.00	571.71	571.71
IIF	Open Water	0.00	594.80	594.80
IIF2	Reservoirs	0.43	4.86	5.29
IIF4b	Sewage Lagoon	0.00	21.14	21.14
IVC	Excavated Lands	0.00	275.32	275.32
VA1	Bldgs/Homes (rural)	0.00	27.19	27.19
VA2	Open Spaces	0.00	69.09	69.09
VB2	Bldgs/Homes (lo den)	168.82	2,524.21	2,693.03
VB3	Open Spaces	3.09	96.21	99.30
VB4	Idle Spaces	73.79	602.45	676.24
VC1	Commercial	5.97	477.01	482.98
VC3	Open Space	0.00	52.23	52.23
		3,203.91	15,032.63	18,243.30

[1]In conducting water-related land use inventories, the division attempts to inventory all lands or areas that consume or evaporate water other than natural precipitation. Non-irrigated agriculture lands are generally mapped if they fall within or border irrigated lands. Non-irrigated lands away from irrigated lands are normally not mapped. Acres shown in the table reflect only the numbers of acres mapped, not the total numbers of acres in the subarea.

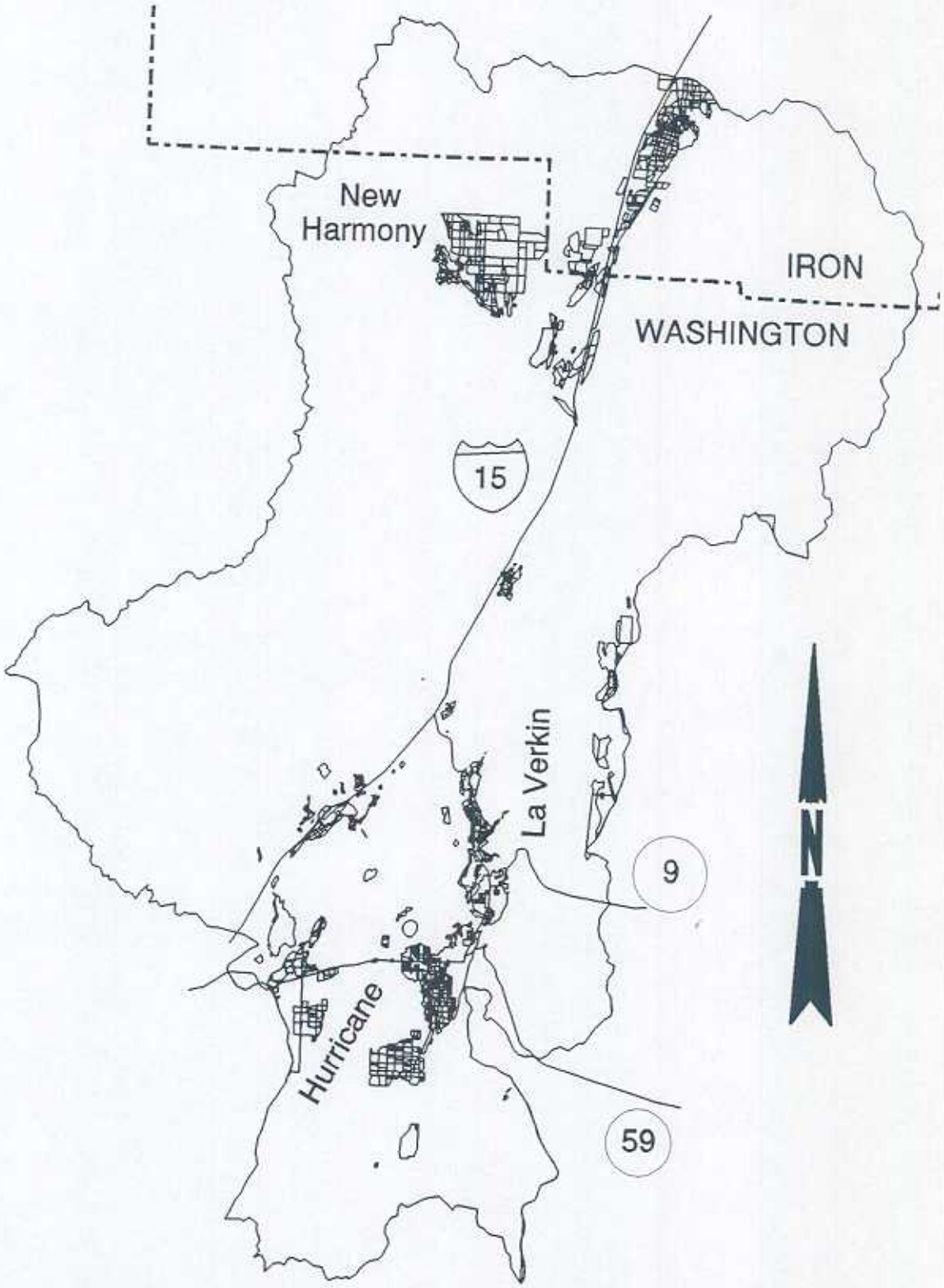

Figure 11. Water-related land use coverage of Hurricane/La Verkin subarea A (10-01-05a).

Land Cover Area Summary for Figure 12.
Hurricane/LaVerkin Subarea B

State Code	Cover Type		Acres
IA2a	Grain		58.82
IA3a	Alfalfa		61.55
IA3c	Grass/Turf		26.51
IA4a	Fallow		183.37
IA4b	Idle		114.52
IB2b	Pasture	(non-irr.)	2,184.66[1]
IB3a	Fallow	(non-irr.)	354.58[1]
IB3b	Idle		42.72
IIE	Riparian		21.70
IVC	Excavated Lands		14.60
VB2	Bldgs/Homes (lo den)		125.72
VB4	Idle Spaces		4.10
			3,192.85

[1]In conducting water-related land use inventories, the division attempts to inventory all lands or areas that consume or evaporate water other than natural precipitation. Non-irrigated agriculture lands are generally mapped if they fall within or border irrigated lands. Non-irrigated lands away from irrigated lands are normally not mapped. Acres shown in the table reflect only the numbers of acres mapped, not the total numbers of acres in the subarea.

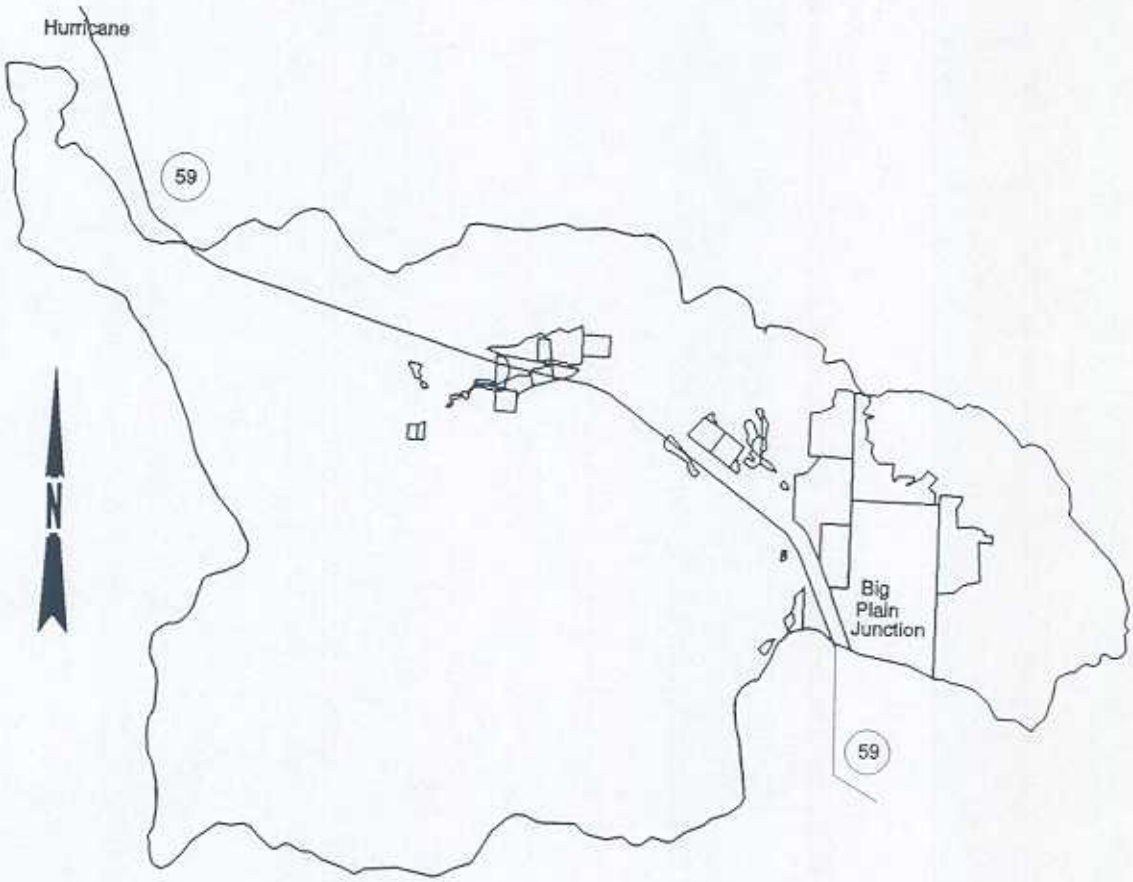

Figure 12. Water-related land use coverage of Hurricane/La Verkin subarea B (10-01-05b).

Land Cover Area Summary for Figure 13.
Pine Valley Subarea

State Code	Cover Type	Acres
IA3a	Alfalfa	23.06
IA3b	Grass Hay	211.96
IA3d	Pasture	732.44
IA4a	Fallow	1.88
IA4b	Idle	5.33
IB2b	Pasture (non-irr.)	501.23[1]
IIE	Riparian	59.97
IIF2	Reservoirs	6.10
IIF3	Ponds & Lakes	9.02
IVC	Excavated Lands	7.39
VA1	Bldgs/Homes (rural)	8.37
VA2	Open Spaces	31.78
VB2	Bldgs/Homes (lo den)	229.71
VB3	Open Spaces	1.17
		1,829.41

[1]In conducting water-related land use inventories, the division attempts to inventory all lands or areas that consume or evaporate water other than natural precipitation. Non-irrigated agriculture lands are generally mapped if they fall within or border irrigated lands. Non-irrigated lands away from irrigated lands are normally not mapped. Acres shown in the table reflect only the numbers of acres mapped, not the total numbers of acres in the subarea.

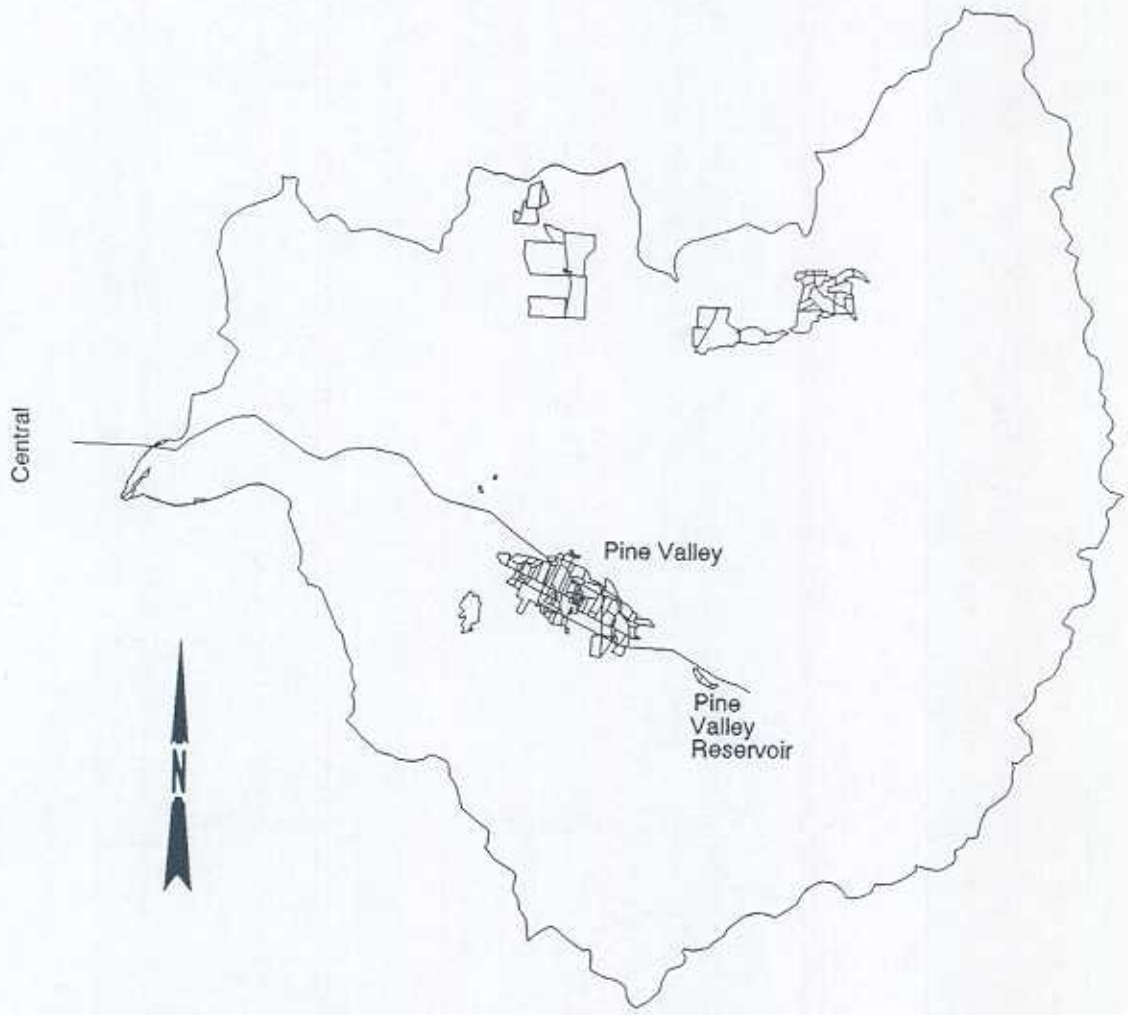

Figure 13. Water-related land use coverage of Pine Valley subarea (10-01-006).

Land Cover Area Summary for Figure 14.
Gunlock Subarea

State Code	Cover Type		Acres
IA1a	Fruit		25.52
IA2a	Grain		75.50
IA2a1	Corn		6.42
IA3a	Alfalfa		388.80
IA3b	Grass Hay		11.84
IA3d	Pasture		869.20
IA4a	Fallow		14.02
IA4b	Idle		392.34
IB2b	Pasture	(non-irr.)	613.02[1]
IB3b	Idle	(non-irr.)	257.28[1]
IIE	Riparian		277.19
IIF	Open Water		17.14
IIF2	Reservoirs		46.55
IIF3	Ponds & Lakes		18.00
IVC	Excavated Lands		34.61
VA1	Bldgs/Homes (rural)		17.41
VA2	Open Spaces		12.01
VB2	Bldgs/Homes (lo den)		759.47
VB3	Open Spaces		4.22
VB4	Idle Spaces		255.07
VC1	Commercial		12.35
			4,107.96

[1]In conducting water-related land use inventories, the division attempts to inventory all lands or areas that consume or evaporate water other than natural precipitation. Non-irrigated agriculture lands are generally mapped if they fall within or border irrigated lands. Non-irrigated lands away from irrigated lands are normally not mapped. Acres shown in the table reflect only the numbers of acres mapped, not the total numbers of acres in the subarea.

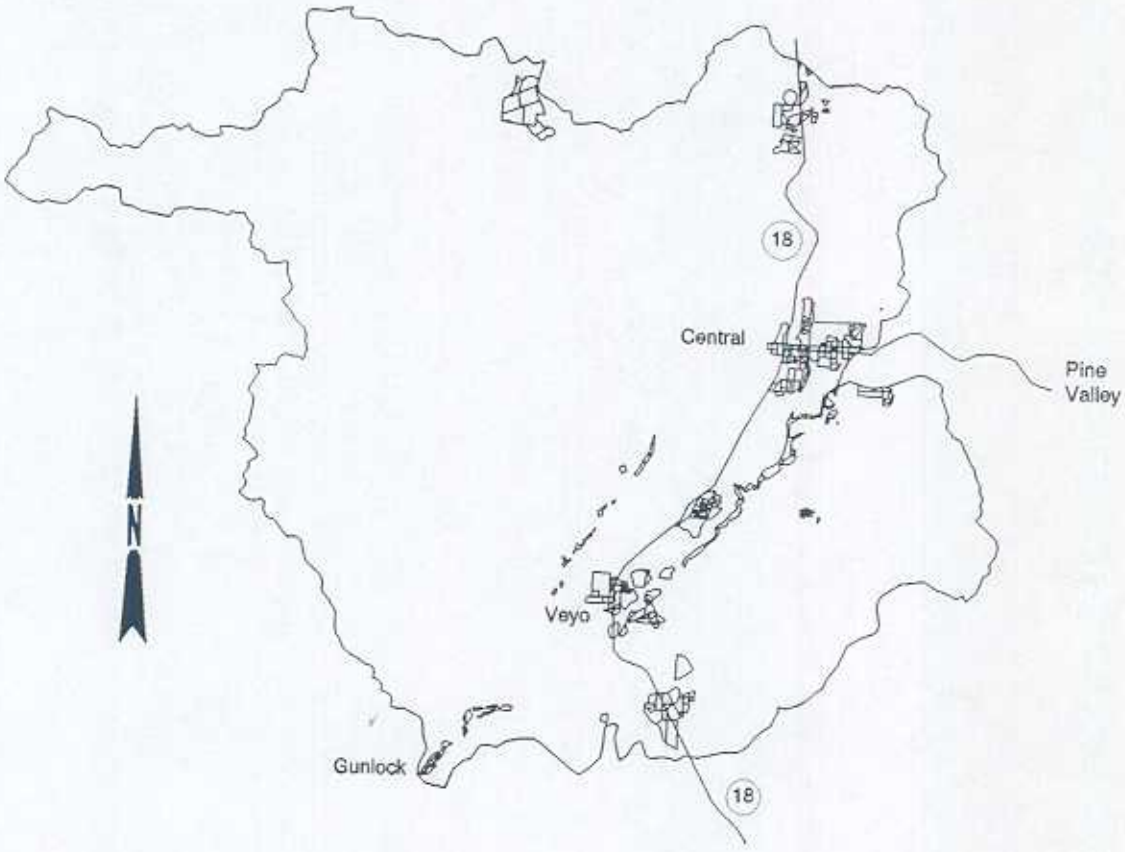

Figure 14. Water-related land use coverage of Gunlock subarea (10-01-007).

Land Cover Area Summary for Figure 15.
Gunlock Reservoir Subarea

State Code	Cover Type	Acres
IA4b	Idle	25.91
IIE	Riparian	46.73
IIF2	Reservoirs	217.02
		289.66

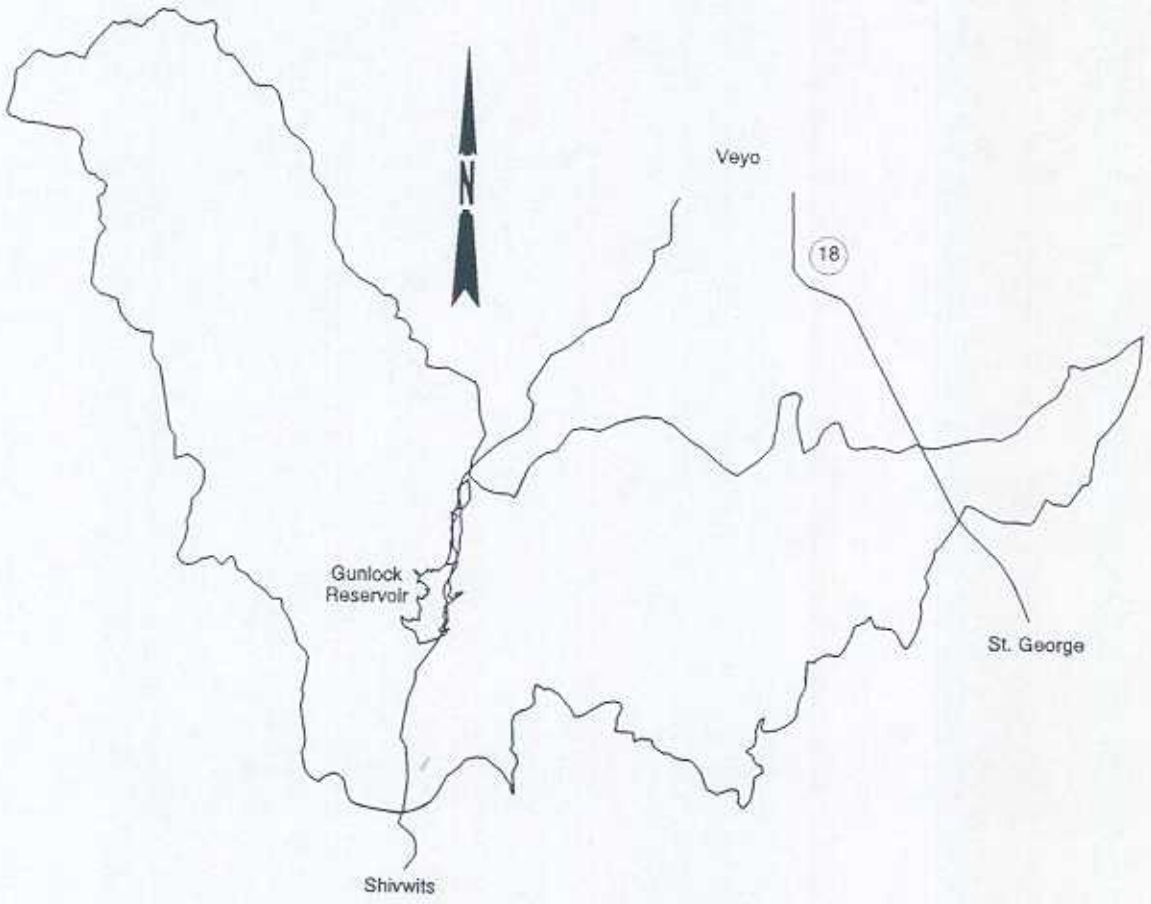

Figure 15. Water-related land use coverage of Gunlock Reservoir subarea (10-01-008).

Land Cover Area Summary for Figure 16.
Santa Clara Subarea

State Code	Cover Type	Acres
IA1a	Fruit	102.40
IA2a	Grain	289.31
IA2a1	Corn	7.30
IA2a2	Sorghum	11.08
IA2c	Other Row Crops	86.65
IA3a	Alfalfa	367.67
IA3b	Grass Hay	40.74
IA3c	Grass/Turf	6.47
IA3d	Pasture	141.32
IA4a	Fallow	44.95
IA4b	Idle	364.47
IB3b	Idle (non-irr.)	94.86[1]
IIA2a	Pasture (sub-irr.)	3.77
IIE	Riparian	817.79
IIF	Open Water	24.69
IVC	Excavated Lands	49.87
VA1	Bldgs/Homes (rural)	14.92
VA2	Open Spaces	131.64
VB1	Bldgs/Homes (hi den)	16.41
VB2	Bldgs/Homes (lo den)	2,126.26
VB3	Open Spaces	493.69
VB4	Idle Spaces	222.19
VC1	Commercial	125.81
VC2	Industrial	202.40
VC3	Open Space	120.21
		5,906.87

[1]In conducting water-related land use inventories, the division attempts to inventory all lands or areas that consume or evaporate water other than natural precipitation. Non-irrigated agriculture lands are generally mapped if they fall within or border irrigated lands. Non-irrigated lands away from irrigated lands are normally not mapped. Acres shown in the table reflect only the numbers of acres mapped, not the total numbers of acres in the subarea.

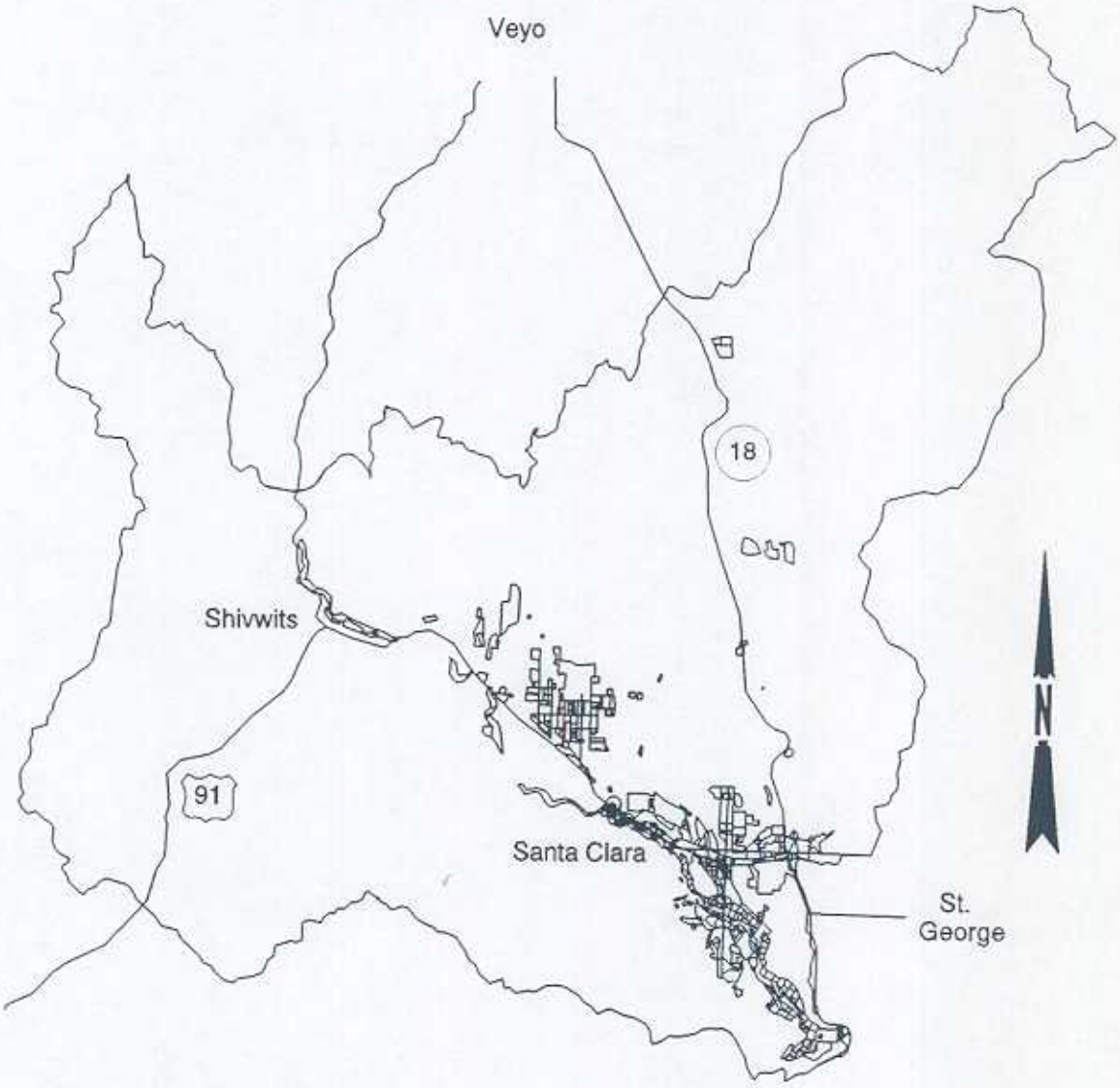

Figure 16. Water-related land use coverage of Santa Clara subarea (10-01-009).

Land Cover Area Summary for Figure 17.
St. George/Washington Subarea A

State Code	Cover Type	Acres
IA1a	Fruit	152.42
IA1c	Vineyard	2.14
IA2a	Grain	85.93
IA2a1	Corn	0.97
IA2a2	Sorghum	13.94
IA2c	Other Row Crops	587.76
IA3a	Alfalfa	2,082.47
IA3b	Grass Hay	65.17
IA3c	Grass/Turf	68.03
IA3d	Pasture	634.48
IA4a	Fallow	169.66
IA4b	Idle	345.00
IIA1a	Pasture	137.42
IIA2a	Pasture	2.49
IIB	Cattail/Bullrush Asp	8.68
IIE	Riparian	1,497.11
IIF	Open Water	19.70
IIF4b	Sewage Lagoon	49.48
IVC	Excavated Lands	19.60
VA1	Bldgs/Homes (rural)	28.39
VA2	Open Spaces	378.37
VB1	Bldgs/Homes (hi den)	1,438.86
VB2	Bldgs/Homes (lo den)	1,320.31
VB3	Open Spaces	219.53
VB4	Idle Spaces	572.95
VC1	Commercial	924.95
VC3	Open Space	92.91
		10,918.72

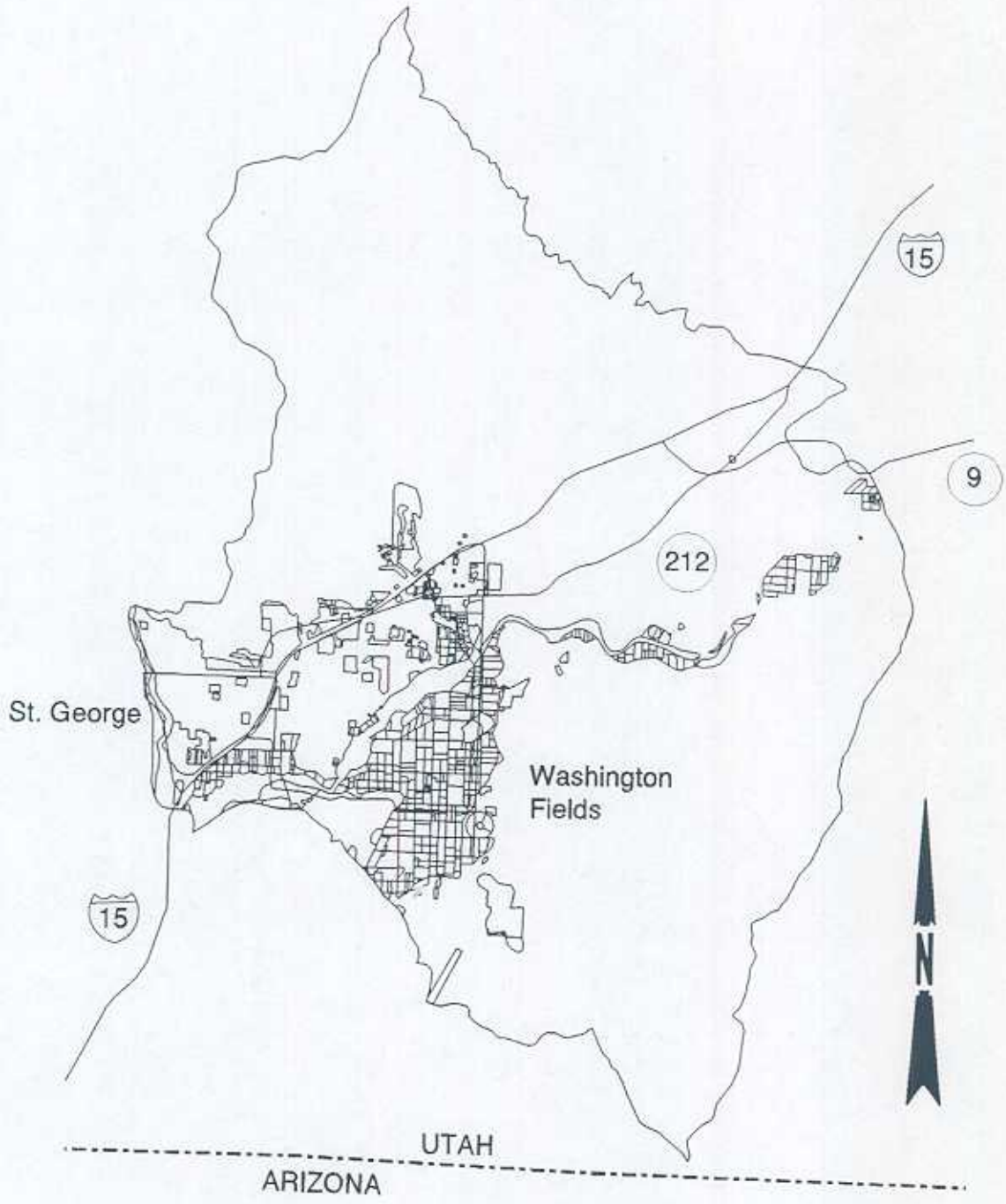

Figure 17. Water-related land use coverage of St. George/Washington subarea A (10-01-10a).

Land Cover Area Summary for Figure 18.
St. George/Washington Subarea B

State Code	Cover Type	Acres
IA2a	Grain	31.76
IA2a1	Corn	18.44
IA2c	Other Row Crops	16.96
IA3a	Alfalfa	521.48
IA3b	Grass Hay	14.40
IA3d	Pasture	57.26
IA4a	Fallow	44.77
IA4b	Idle	258.90
IB2b	Pasture (non-irr.)	256.12[1]
IB3b	Idle (non-irr.)	214.48[1]
IIE	Riparian	194.85
IIF	Open Water	9.84
IVC	Excavated Lands	54.81
VA	Farmsteads	2.58
VA1	Bldgs/Homes (rural)	17.97
VA2	Open Spaces	157.36
VB1	Bldgs/Homes (hi den)	336.06
VB2	Bldgs/Homes (lo den)	509.12
VB3	Open Spaces	171.26
VB4	Idle Spaces	145.66
VC1	Commercial	87.38
VC3	Open Space	6.98
		3,128.44

[1]In conducting water-related land use inventories, the division attempts to inventory all lands or areas that consume or evaporate water other than natural precipitation. Non-irrigated agriculture lands are generally mapped if they fall within or border irrigated lands. Non-irrigated lands away from irrigated lands are normally not mapped. Acres shown in the table reflect only the numbers of acres mapped, not the total numbers of acres in the subarea.

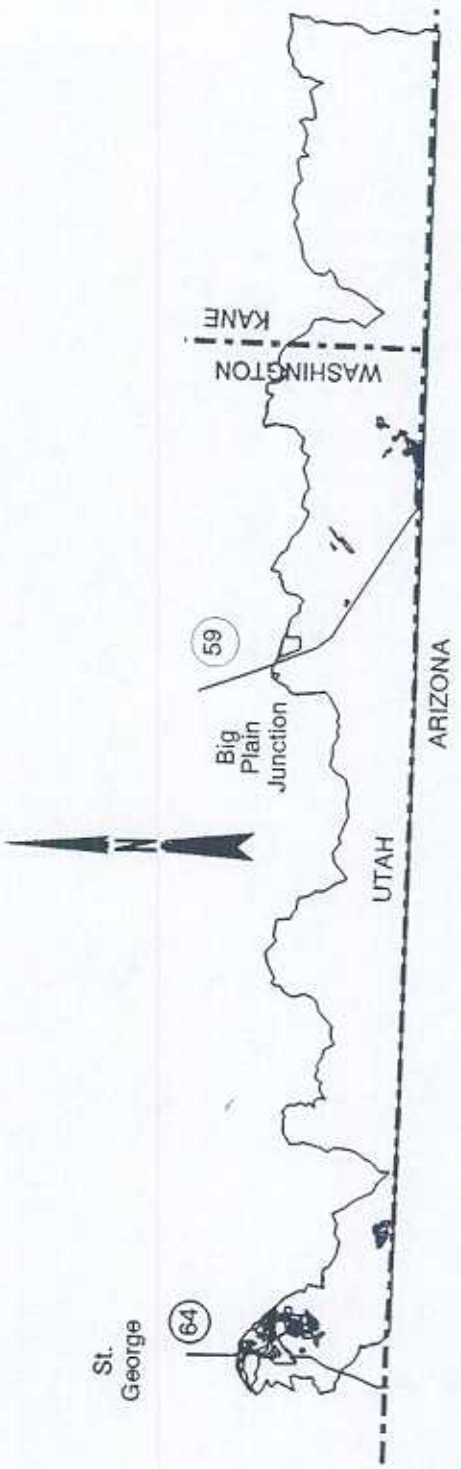

Figure 18. Water-related land use coverage of St. George/Hurricane subarea B (10-01-10b).

Land Cover Area Summary for Figure 19.
Littlefield Subarea

State Code	Cover Type	Acres
IA1a	Fruit	1.89
IA3a	Alfalfa	33.91
IA3d	Pasture	93.82
IA4a	Fallow	22.60
IA4b	Idle	65.01
IB2b	Pasture (non-irr.)	192.24[1]
IB3a	Fallow (non-irr.)	19.12[1]
IB3b	Idle (non-irr.)	41.23[1]
IIE	Riparian	763.36
IIF	Open Water	10.65
IIF3	Ponds & Lakes	0.78
IIF4c	Evaporation Pond	2.72
IVC	Excavated Lands	221.81
VA1	Bldgs/Homes (rural)	3.71
VA2	Open Spaces	6.58
VB2	Bldgs/Homes (lo den)	899.10
VB3	Open Spaces	158.91
VB4	Idle Spaces	134.43
VC1	Commercial	22.25
		2,694.12

[1]In conducting water-related land use inventories, the division attempts to inventory all lands or areas that consume or evaporate water other than natural precipitation. Non-irrigated agriculture lands are generally mapped if they fall within or border irrigated lands. Non-irrigated lands away from irrigated lands are normally not mapped. Acres shown in the table reflect only the numbers of acres mapped, not the total numbers of acres in the subarea.

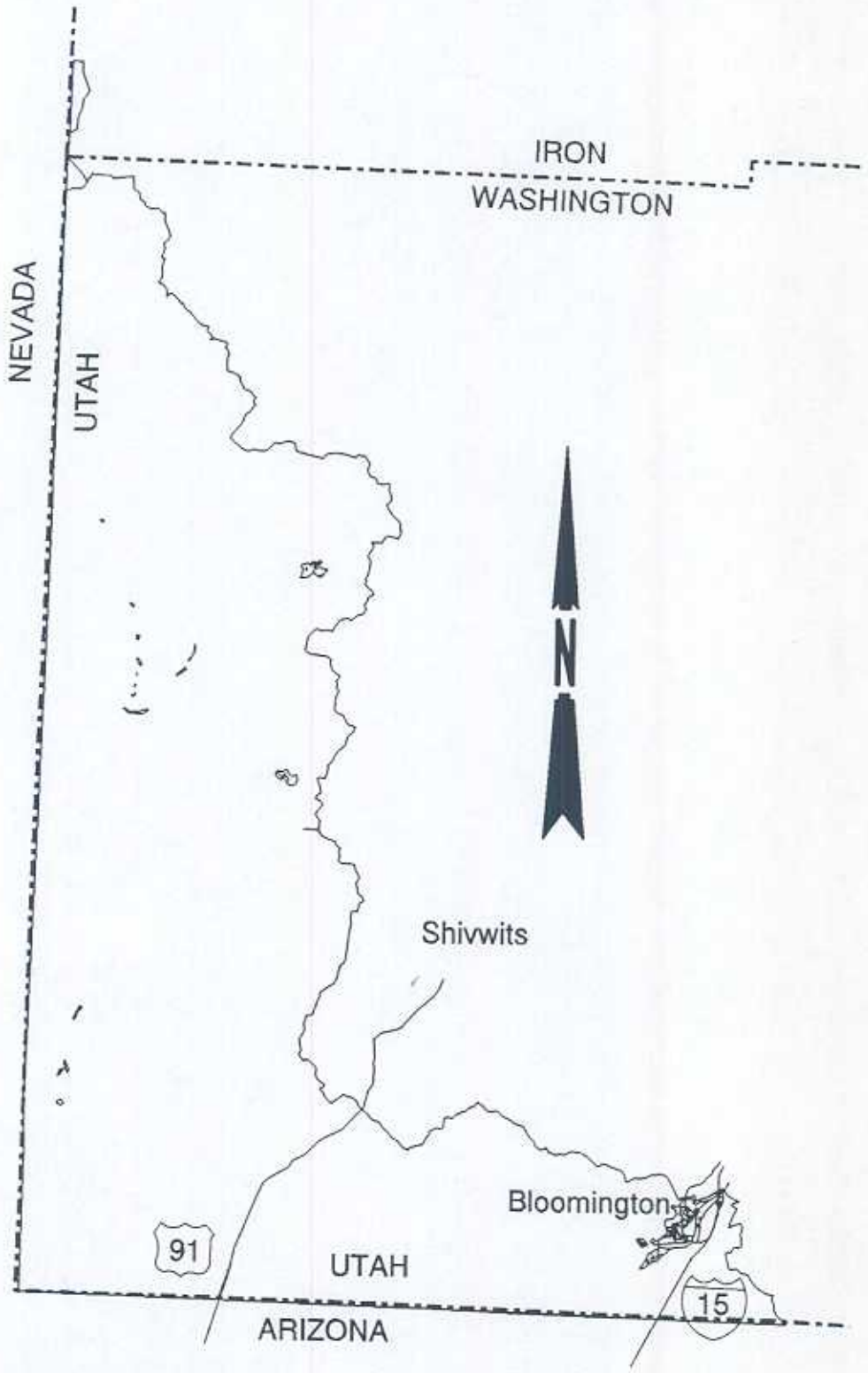

Figure 19. Water-related land use coverage of Littlefield subarea (10-01-011).

The water-related land cover for all the subareas in the study area is summarized in Table 2, and water-related land cover for the counties is summarized in Table 3.

The division inventoried over 75,940 acres of land in the Kanab Creek-Virgin River Study Unit. This amounts to only 3.4 percent of the entire land area in the Kanab Creek/Virgin River Basin. Areas not inventoried are mainly national forests and rangeland. Of the inventoried acres, 25,603 are irrigated land (including land that is fallow or idle), 7,931 are wet/open water areas (including reservoirs), and 21,190 are residential/ industrial areas (including farmsteads and rural housing).

Table 2. Summary of land cover by subarea for the Kanab Creek/Virgin River Basin (acres).

Code	Cover	Johnson Wash 10-02-001	Kanab Creek 10-02-002	Up. Lg.Valley 10-01-001	Low. Lg. Valley 10-01-002	N. Fk. Virgin 10-01-003
IA1a	Fruit	0	6	0	90	0
IA1e	Other Horticulture	0	0	0	0	0
IA2a	Grain	30	39	0	117	0
IA2a1	Corn	0	0	0	9	0
IA2b	Vegetables	0	0	0	0	0
IA2b1	Potatoes	0	0	0	0	0
IA2b2	Onions	0	0	0	0	0
IA2b3	Beans	0	0	0	0	0
IA2c	Other Row Crops	0	0	0	0	0
IA3a	Alfalfa	572	863	17	771	0
IA3b	Grass Hay	10	174	29	55	0
IA3c	Grass/Turf	0	0	0	0	0
IA3d	Pasture	550	820	284	328	891
IA4a	Fallow	0	99	0	17	0
IA4b	Idle Overgrown	1,509	117	0	28	42
IIA1a	Pasture (surf. & sub.)	0	31	0	0	115
IIA1b	Grass Hay (surf. & sub.)	0	0	0	0	0
Surface Irr. Cropland Subtotal		2,671	2,149	330	1,415	1,048
IIA2a	Sub. Irr. Pasture	0	147	0	0	0
IIA2b	Sub. Irr. Grass Hay	0	0	0	0	0
Sub. Irr. Cropland Subtotal		0	147	0	0	0
Irrigated Croplands Subtotal		2,671	2,296	330	1,415	1,048
IIB	Cattail/Bullrush Aspect	0	14	0	0	0
IIB-E	Wet/Vegetation Asp.	0	0	0	0	0
IIC	Wet Flats	0	0	0	0	0
IIE	Riparian	185	714	79	39	41
IIF	Open Water	0	4	33	17	22
IIF2	Reservoirs	74	57	0	32	165
IIF4a	Temporary Flooded	0	0	0	7	0
IIF4b	Sewage Lagoon	0	120	0	0	0
IIF4c	Evaporation Pond	0	0	0	7	0
Wet/Open Water Subtotal		259	909	112	102	228
VA	Farmsteads	91	72	4	23	14
VB	Residential	219	1,747	14	360	689
VB3	Open Spaces	0	84	5	29	18
VC	Commercial/Industrial	42	274	0	13	8
Residential/Industrial Subtotal		352	2,177	24	425	729
Land Use/Land Cover Totals		3,282	5,382	466	1,942	2,005

Table 2. Continued.

Code	Cover	Virg./Spgdale 10-01-004	Hurr./Laverk 10-01-05a	Hurr./Laverk 10-01-05b	Pine Valley 10-01-006	Gunlock 10-01-007
IA1a	Fruit	38	383	0	0	26
IA1e	Other Horticulture	0	0	0	0	0
IA2a	Grain	0	224	59	0	76
IA2a1	Corn	15	13	0	0	6
IA2b	Vegetables	0	0	0	0	0
IA2b1	Potatoes	0	0	0	0	0
IA2b2	Onions	0	0	0	0	0
IA2b3	Beans	0	0	0	0	0
IA2c	Other Row Crops	0	8	0	0	0
IA3a	Alfalfa	287	1,229	62	23	389
IA3b	Grass Hay	4	114	0	212	12
IA3c	Grass/Turf	0	27	27	0	0
IA3d	Pasture	637	2,124	0	732	869
IA4a	Fallow	10	227	183	2	14
IA4b	Idle Overgrown	57	2,092	115	5	392
IIA1a	Pasture (surf. & sub.)	63	15	0	0	0
IIA1b	Grass Hay (surf. & sub.)	0	0	0	0	0
Surface Irr. Cropland Subtotal		1,111	6,456	446	974	1,784
IIA2a	Sub. Irr. Pasture	0	54	0	0	0
IIA2b	Sub. Irr. Grass Hay	0	0	0	0	0
Sub. Irr. Cropland Subtotal		0	54	0	0	0
Irrigated Croplands Subtotal		1,111	6,510	446	974	1,784
IIB	Cattail/Bullrush Aspect	0	0	0	0	0
IIB-E	Wet/Vegetation Asp.	0	0	0	0	0
IIC	Wet Flats	0	0	0	0	0
IIE	Riparian	935	572	22	60	277
IIF	Open Water	6	595	0	9	35
IIF2	Reservoirs	42	5	0	6	47
IIF4a	Temporary Flooded	0	0	0	0	0
IIF4b	Sewage Lagoon	25	21	0	0	0
IIF4c	Evaporation Pond	0	0	0	0	0
Wet/Open Water Subtotal		1,008	1,193	22	75	359
VA	Farmsteads	6	96	0	40	29
VB	Residential	697	3,370	130	230	1,015
VB3	Open Spaces	56	99	0	1	4
VC	Commercial/Industrial	73	535	0	0	12
Residential/Industrial Subtotal		832	4,100	130	271	1,060
Land Use/Land Cover Totals		2,951	11,803	598	1,320	3,203

Table 2. Continued.

Code	Cover	Gunlock Res. 10-01-008	Santa Clara 10-01-009	St. G/Wash. 10-01-10a	St. G/Wash. 10-01-10b	Littlefield 10-01-011	Total
IA1a	Fruit	0	102	152	0	2	799
IA1e	Other Horticulture	0	0	2	0	0	2
IA2a	Grain	0	289	86	32	0	952
IA2a1	Corn	0	7	1	18	0	69
IA2b	Vegetables	0	0	0	0	0	0
IA2b1	Potatoes	0	0	0	0	0	0
IA2b2	Onions	0	0	0	0	0	0
IA2b3	Beans	0	0	0	0	0	0
IA2c	Other Row Crops	0	98	602	17	0	725
IA3a	Alfalfa	0	368	2,082	521	34	7,218
IA3b	Grass Hay	0	41	65	14	0	730
IA3c	Grass/Turf	0	6	68	0	0	128
IA3d	Pasture	0	141	634	57	94	8,161
IA4a	Fallow	0	45	170	45	23	835
IA4b	Idle Overgrown	26	364	345	259	65	5,416
IIA1a	Pasture (surf. & sub.)	0	0	137	0	0	361
IIA1b	Grass Hay (surf. & sub.)	0	0	0	0	0	0
Surface Irr. Cropland Subtotal		26	1,461	4,344	963	218	25,396
IIA2a	Sub. Irr. Pasture	0	4	2	0	0	207
IIA2b	Sub. Irr. Grass Hay	0	0	0	0	0	0
Sub. Irr. Cropland Subtotal		0	4	2	0	0	207
Irrigated Croplands Subtotal		26	1,465	4,346	963	218	25,603
IIB	Cattail/Bullrush Aspect	0	0	9	0	0	23
IIB-E	Wet/Vegetation Asp.	0	0	0	0	0	0
IIC	Wet Flats	0	0	0	0	0	0
IIE	Riparian	47	818	1,497	195	763	6,244
IIF	Open Water	0	25	20	10	11	787
IIF2	Reservoirs	217	0	0	0	0	645
IIF4a	Temporary Flooded	0	0	0	0	0	7
IIF4b	Sewage Lagoon	0	0	49	0	0	215
IIF4c	Evaporation Pond	0	0	0	0	3	10
Wet/Open Water Subtotal		264	843	1,575	205	777	7,931
VA	Farmsteads	0	147	407	178	10	1,117
VB	Residential	0	2,365	3,332	991	1,034	16,193
VB3	Open Spaces	0	494	220	171	159	1,341
VC	Commercial/Industrial	0	448	1,018	94	22	2,539
Residential/Industrial Subtotal		0	3,454	4,977	1,434	1,225	21,190
Land Use/Land Cover Totals		290	5,762	10,898	2,602	2,220	54,724

Table 3. Summary of land cover by county for the Kanab Creek/Virgin River Basin (acres).

Code	Cover	Iron Co.	Kane Co.	Washington Co.	Total
IA1a	Fruit	0	71	728	799
IA1e	Other Horticulture	0	0	2	2
IA2a	Grain	0	126	826	952
IA2a1	Corn	0	9	60	69
IA2b	Vegetables	0	0	0	0
IA2b1	Potatoes	0	0	0	0
IA2b2	Onions	0	0	0	0
IA2b3	Beans	0	0	0	0
IA2c	Other Row Crops	0	0	725	725
IA3a	Alfalfa	255	2,195	4,768	7,218
IA3b	Grass Hay	0	268	462	730
IA3c	Grass/Turf	3	0	125	128
IA3d	Pasture	659	2,639	4,863	8,161
IA4a	Fallow	72	101	662	835
IA4b	Idle Overgrown	518	1,696	3,202	5,416
IIA1a	Pasture (surf. & sub.)	15	146	200	361
IIA1b	Grass Hay (surf. & sub.)	0	0	0	0
Surface Irr. Cropland Subtotal		1,522	7,251	16,623	25,396
IIA2a	Sub. Irr. Pasture	0	147	60	207
IIA2b	Sub. Irr. Grass Hay	0	0	0	0
Sub. Irr. Cropland Subtotal		0	147	60	207
Irrigated Croplands Subtotal		1,522	7,398	16,683	25,603
IIB	Cattail/Bullrush Aspect	0	14	9	23
IIB-E	Wet/Vegetation Asp.	0	0	0	0
IIC	Wet Flats	0	0	0	0
IIE	Riparian	0	1,058	5,186	6,244
IIF	Open Water	13	63	711	787
IIF2	Reservoirs	0	137	508	645
IIF4a	Temporary Flooded	0	7	0	7
IIF4b	Sewage Lagoon	0	120	95	215
IIF4c	Evaporation Pond	0	7	3	10
Wet/Open Water Subtotal		13	1,406	6,512	7,931
VA	Farmsteads	0	204	913	1,117
VB	Residential	264	2,340	13,589	16,193
VB3	Open Spaces	3	119	1,219	1,341
VC	Commercial/Industrial	6	337	2,196	2,539
Residential/Industrial Subtotal		273	3,000	17,917	21,190
Land Use/Land Cover Totals		1,808	11,804	41,112	54,724

METHODOLOGY FOR GATHERING LAND USE DATA

Background

The methodology used by the division over the past 25 years in conducting water-related land use studies has varied with regard to the procedures used, detail, etc. Earlier inventories were prepared with large format vertical-aerial photographs supplemented with field surveys to label boundaries, vegetation types and other water use information.

After identifying crops and labeling photographs, the photographs were projected onto a base map and then planimetered or "dot-counted" to determine the acreage. Tables for individual townships and ranges were prepared showing total land within every section and the amount of land in each land use category. Data were then available for use in preparing water budgets.

The water-related land use inventories completed by the division and the U.S. Soil Conservation Service (SCS) over the last 25 years have essentially covered the entire state. The two agencies have inventoried about 4 million acres (including 1.4 million acres of irrigated land) in order to acquire the data needed to prepare hydrologic inventories and to conduct other water-related studies in Utah.

In the early 1980s the division began updating its methodology for collecting water-related land use data to take advantage of the rapidly growing fields of remotely sensed data and computerized Geographic Information Systems (GIS). Updating land use data for each hydrologic area of the state is an on-going process, and the division has now developed procedures for consistent data gathering and for updating it at 7- to 10-year intervals.

For several years the division contracted with the University of Utah Research Institute, Center for Remote Sensing and Cartography (CRSC), to prepare water-related land use inventories. During this period, water-related land use data were obtained by using high altitude color infrared photography and laboratory interpretation, with field checking. More recently the division has entered into cooperative agreements with several federal and other state agencies to complete and update all land use data for the state of Utah.

Present Method

In March 1984 several division staff members visited the California Department of Water Resources to observe its methodology for collecting water-related land use data for state water planning purposes. The division, based on its review of the California methodology and its own experience, developed a water-related land use inventory program. This program includes the use of 35mm slides, USGS 7-1/2 minute quadrangle maps, field-mapping using base maps produced from the 35mm photography, and a computerized geographic information system to process, store, and retrieve land use data.

The first step in a water-related land use inventory is to identify areas to be covered with aerial photography for any individual year. These areas are identified on maps of suitable scale (usually 1:100,000) using previous land use studies and other available information such as maps generated from high altitude color infrared photography or Landsat. Flight lines are plotted on the maps show land areas to be covered with aerial photography. Flight lines are generally plotted running north and south through the center of the sections to be photographed. An exception to the

practice is a long narrow canyon with irrigated land only in the bottom. When this situation is encountered, the flight line will follow the canyon without regard to section lines or compass directions.

During the second step, identified areas are photographed using 35mm slide film. Ideally, the 35mm photography should be conducted at a time of year that shows the highest contrast between the water-related land use areas (mainly irrigated land) and surrounding areas. When field mapping/checking is to be conducted in the same season, the photographs are taken as early in the growing season as possible. The division has generally found that the period from June 15 to July 15 is the best time for this photography. The division specifies that aerial photographs be obtained using an aircraft (Figure 20) carrying a high quality 35mm single lens reflex camera mounted to focus along a vertical axis to the earth. A 24mm lens is required and photos must be taken between 6,000 and 6,500 feet above the ground. This procedure allows each slide to cover a little more than one square mile with approximately 30 percent overlap on the wide side of the slide and 5 percent on the slide's narrow side. High quality commercial color positive film is used with appropriate commercial processing after each day's flight. The slides are then cataloged according to the flight-line number and shown on a location map. All 35mm slides are stored in files at the division offices and cataloged according to individual quadrangle map location.

After cataloging the slides, the division transfers boundaries of water-related areas from the slide to USGS 7-1/2 minute quadrangle maps using a standard slide projector with a 100-200mm zoom lens. The image is directed from the projector, located below a glass table top, to a 45 degree first surface mirror to the back of a quadrangle map. The image showing through

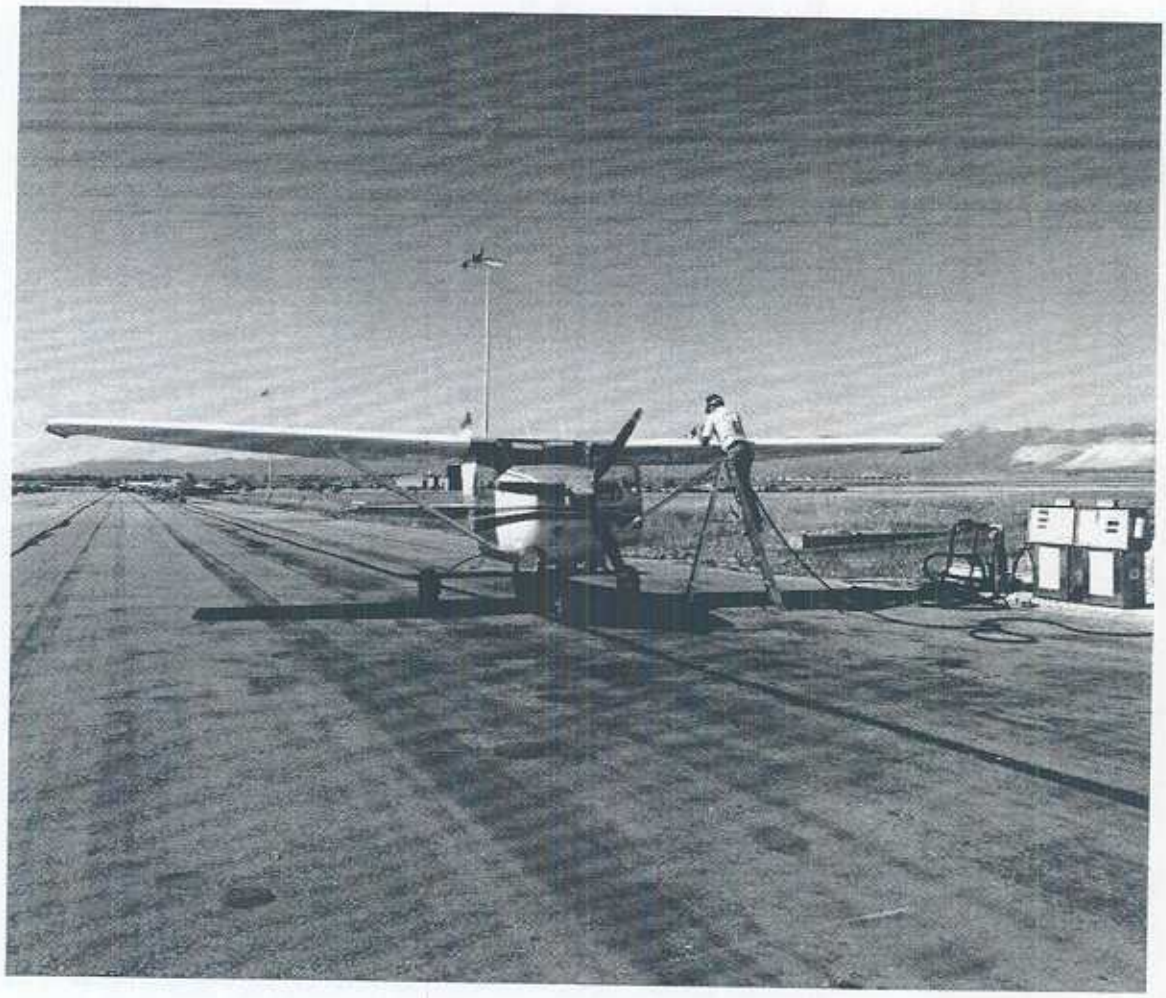

Figure 20. Typical aircraft used for aerial photography.

the map is adjusted to the map scale with the zoom lens. Field boundaries and other water-use boundaries are then traced on the 7-1/2 minute quadrangle map. At the same time, a technician attempts to identify the category of land use or land cover and uses a code for the appropriate category in each water use area on the field map. The date that transfer of slide data was completed is also noted on the map. Figure 21 illustrates this basic procedure.

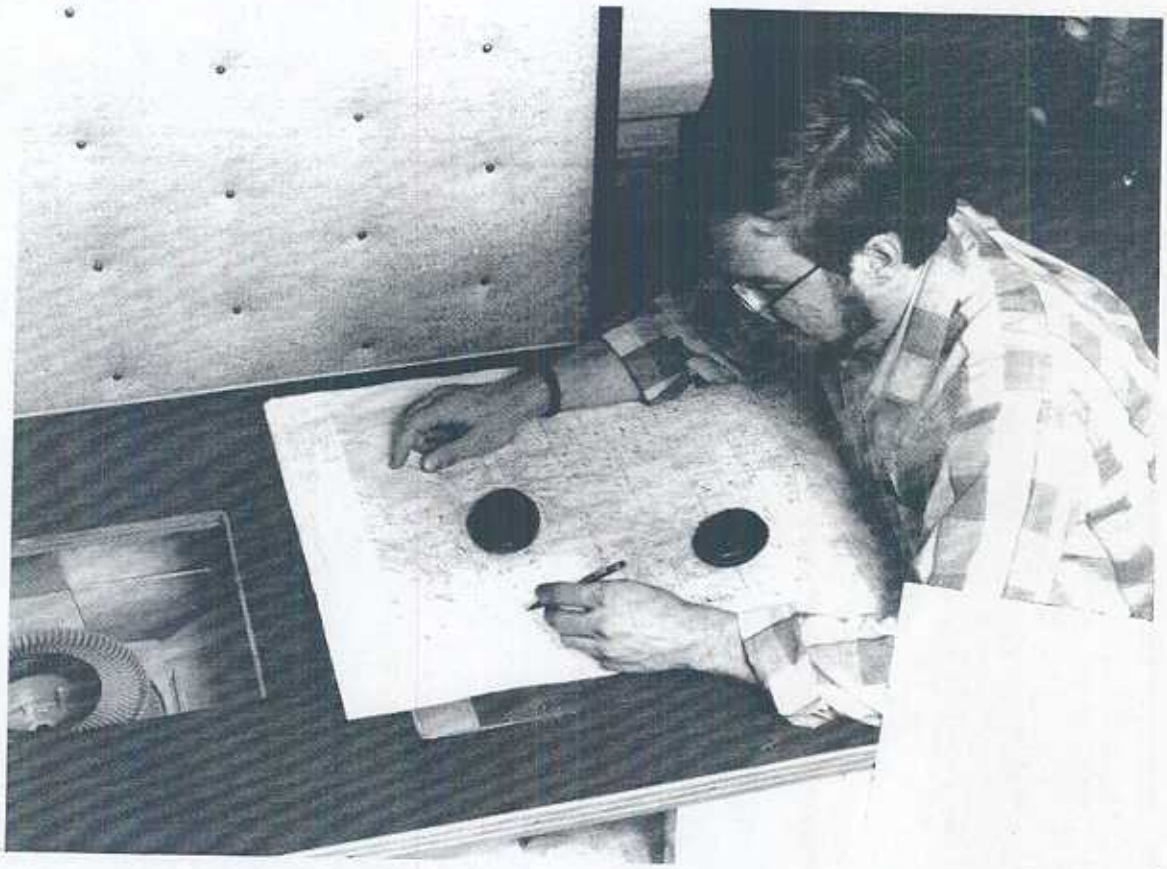

Figure 21. Mapper transferring slide data to field map.

After the slide data is transferred to the quadrangle map, a two-person team uses the map in the field to check the boundaries and land use data on the quadrangle and marks in red the actual land use or land cover category if it is different than the category originally identified. After the land classification on the quadrangle map has been field-checked, the field team marks the completion date on the edge of the map. Figure 22 shows a Division of Water Resources field map after field-checking has been completed.

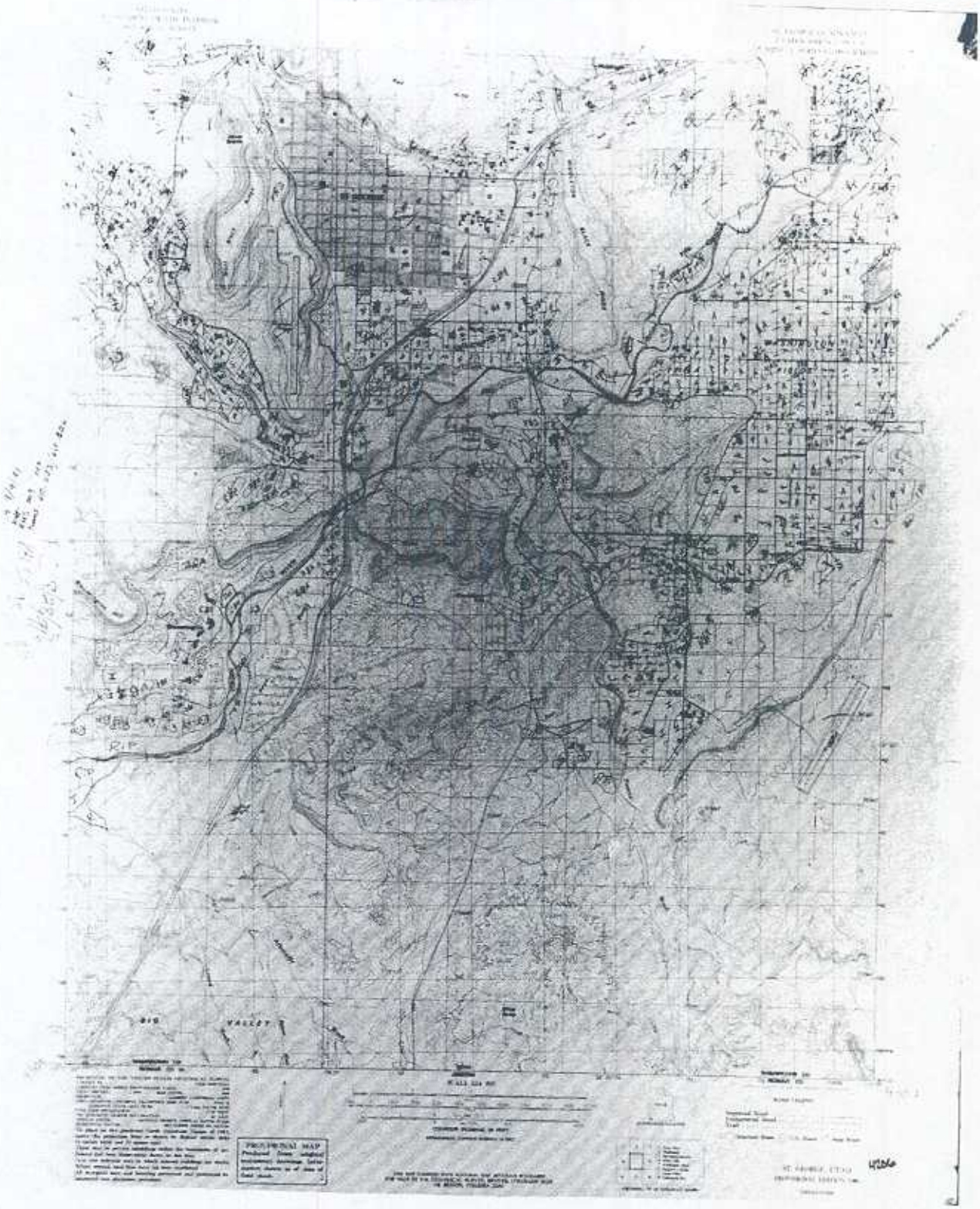

Figure 22. Field map after field checking has been completed (St. George Quadrangle).

The next step is to digitize and process the field data. Digitizing is the process of converting data from map or image form to digital form for computer analysis. Typically, digitizing and entering the categories of land use into the computer is performed during the fall and winter following the aerial photography. This is accomplished by using ESRI ARC/INFO Software and a digitizer board large enough to hold a quadrangle map. The division's digitizing work station is shown in Figure 23. All processed data is filed in the State AGRC database. The division uses the special data management and geographic information management capabilities of the AGR ARC/INFO system to produce tabulated water-related land use maps.

Figure 23. Digitizing work station.

Once the land use data has been digitized and processed through the AGRC ARC/INFO system, the division plots out a 7-1/2 minute quadrangle line map of the data. These plots are overlaid on the field maps to check for errors in recording or digitizing. An example of a line map of the St. George quadrangle is shown in Figure 24.

Computer-Generated Line Map legend for Figure 24.
Kanab Creek/Virgin River Basin

Label	Code	Cover Type
O	IA1a	Orchards
BR	IA1e	Berries
G	IA2a	Grain
C	IA2a1	Corn
V	IA2b	Vegetables
PO	IA2b1	Potatoes
ON	IA2b2	Onions
B	IA2b3	Beans
T	IA2b4	Tomatoes
S	IA2c	Other Row Crops
A	IA3a	Alfalfa
P1	IA3b	Grass Hay
P	IA3d	Pasture
TF	IA3e	Turf/Grass Yards
F	IA4a	Idle-Plowed
I	IA4b	Idle-Overgrown
DG	IB1a	Non Irr. Crops
DA	IB2a	Non Irr. Alfalfa
DP	IB2b	Non Irr. Pasture
DF	IB3a	Non Irr. Idle-Plowed
DI	IB3b	Non Irr. Idle-Overgrown
IWP	IIA2a1	Irrigated Wet Pasture
IWP1	IIA2a2	Irrigated Wet Grass Hay
WP	IIA2b1	Wet Pasture/Non Irr.
WP1	IIA2b2	Non Irr. F.W. Hayland
WF	IIC	Wet Flats
WR	IIB	Cattail/Bullrush
W	IIF	Open Water
WM	IIF4a	Temp. Flooded/Marsh
SL	IIF4b	Sewage Lagoons
EP	IIF4c	Evaporation Pond
R	VB1	Buildings/Homes
R2	VB2	Buildings/Homes
RP	VB3	Open Spaces
R	VB6a	Residential
CM	VC1	Commercial
CI	VC2	Industrial
CS	VC3	Open Spaces

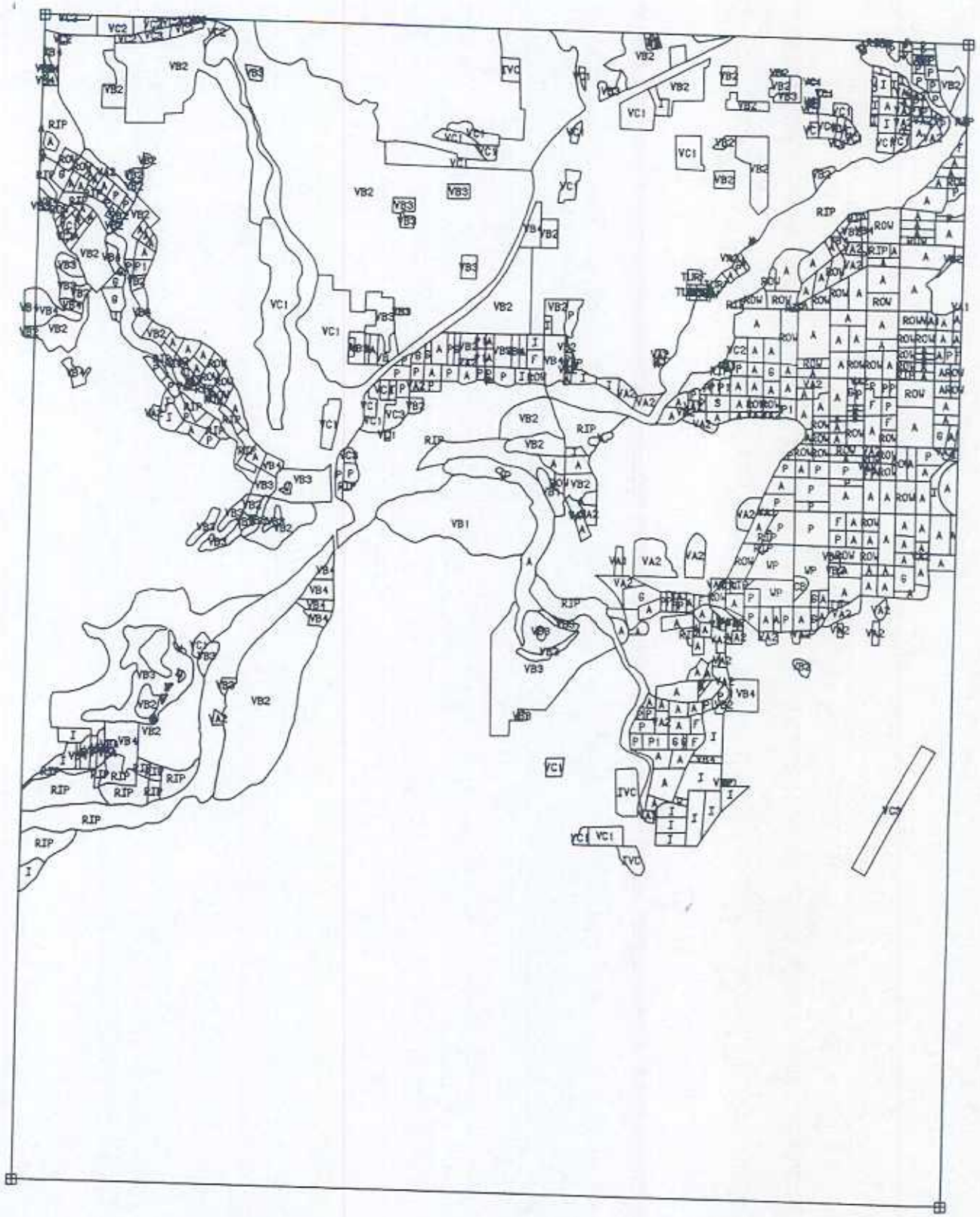

Figure 24. Computer-generated line map of the St. George 7-1/2 minute quadrangle.

Once checked, the data in the AGRC ARC/INFO system become available for use in water resource planning studies. A map of the St. George quadrangle, similar to what might be obtained from the AGRC, is shown in Figure 25.

Computer-generated map legend for Figure 25.
Kanab Creek/Virgin River Basin

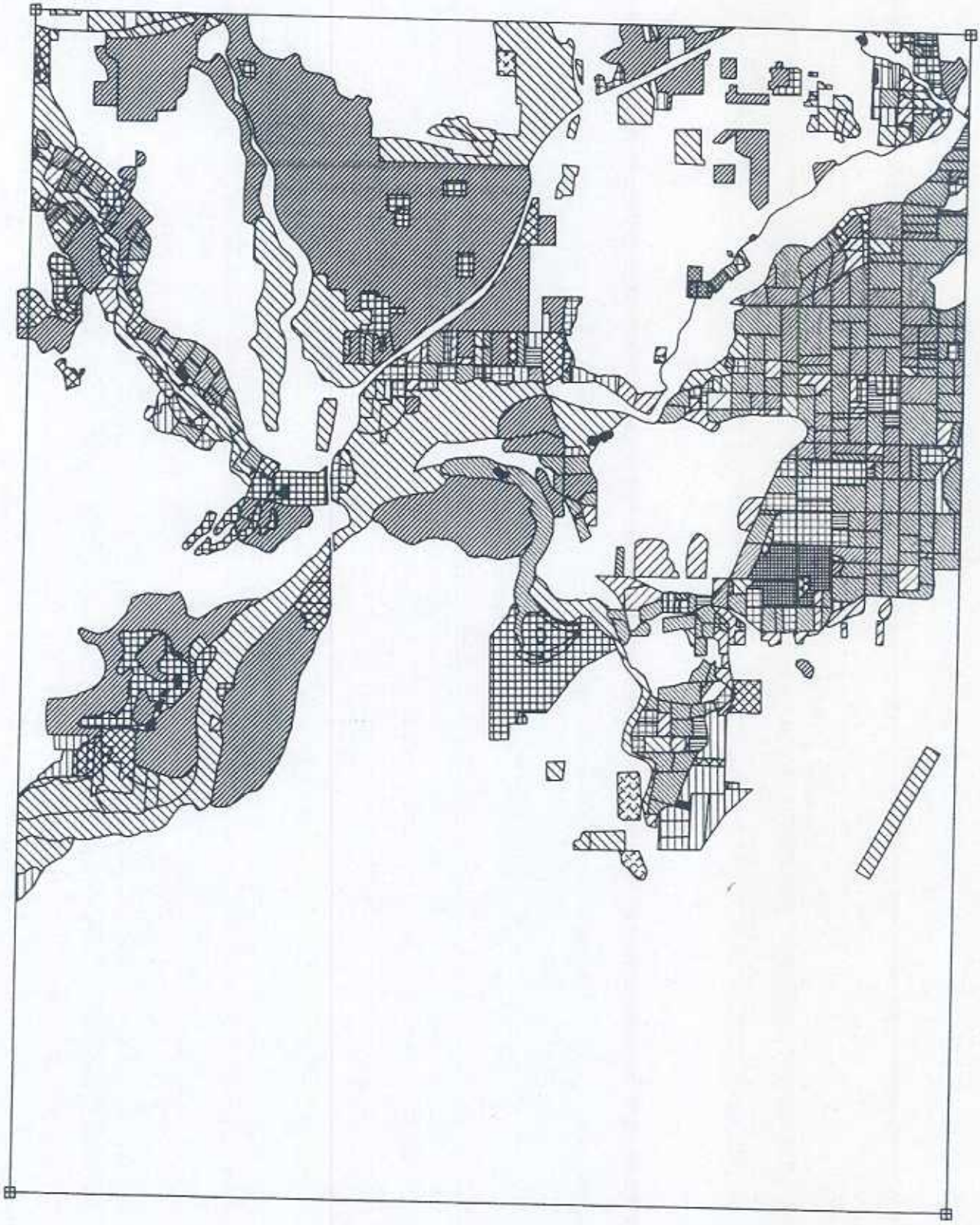

Figure 25. Final computer-generated map of the St. George 7-1/2 minute quadrangle.

LAND USE CATEGORIES

During the division's years of collecting water-related land use data, land use categories and map codes have varied from inventory to inventory.

In late 1984, at the beginning of the division's new phase of mapping water-related land use, an Active Mappers Committee was formed. The committee reviewed all ongoing mapping efforts in the state and then focused on the issue of coordinating and standardizing map data. A summary of the committee's work is given in Appendix B. The division is committed to using the *1988 Standard Cover Types and Codes List* developed from this committee. Codes from this standard cover type list, with descriptive information, are shown in Table 1.

As each water-related land use inventory for the state is completed, and also, when some areas are re-inventoried, it is useful in some instances to tabulate and compare inventories and respective changes. Because of the different names of cover type and codes that were used earlier to the *1988 Standard Cover Types and Codes List*, it becomes necessary that earlier names of cover types and codes should be provided in this report. Table 4 shows the codes from earlier studies that relate to the standard cover types. Appendix C lists the previous land use studies conducted by the division.

Table 4. List of cover types and land use codes (standardized in 1988) for the State of Utah with the state code and comparisons of the 1988 standard code and cover type to previous land use inventories.

STATE CODE	COVER TYPES (Standardized in 1988)	UTAH LK. (66)[a] BEAR R. (69) WEBER R. (70)	UINTAH (67) W. COLO. (67) VIRGIN R.(78) UINTA B. (80)	SALT LAKE COUNTY (82)	U. SEVIER (81) M. SEVIER (83) L. SEVIER (85) BEAR R. (86) WEBER R. (87)
I	Cropland	-[b]	-	-	*[c]
IA	Irrigated	A[d]	A	-	*
IA1	Hort. & Specialty Crops	-	-	-	*
IA1a	Fruit	A8	A16	-	*
IA1a1	Cherry	-	-	-	*
IA1a2	Apple	-	-	-	*
IA1a3	Peach	-	-	-	*
IA1a4	Pear	-	-	-	*
IA1a5	Apricot	-	-	-	*
IA1a6	Other	-	-	-	*
IA1b	Nuts	-	-	-	*
IA1b1	Walnut	-	-	-	*
IA1b2	Pecan	-	-	-	*
IA1b3	Other	-	-	-	*
IA1c	Vineyard	-	-	-	*
IA1d	Bush Fruit	-	-	-	*
IA1e	Berries	-	-	-	*
IA1f	Nurseries	-	-	-	*
IA1g	Other	-	-	-	*
IA2	Row & Close-Grown Crops	-	-	-	*
IA2a	Grain	A4	-	Ag	*
IA2a1	Corn	A5	A1	-	*
IA2a2	Sorghum	-	-	-	*
IA2a3	Wheat	-	A9	-	*
IA2a4	Barley	-	A7	-	*
IA2a5	Oats	-	A8	-	*
IA2a6	Other	-	-	-	*
IA2b	Vegetables	-	-	-	*
IA2b1	Potatoes	A7	A3	-	*
IA2b2	Onions	-	-	-	*
IA2b3	Beans	A13	-	-	*
IA2b4	Tomatoes	A10	A5	-	*
IA2b5	Sweet Corn	-	-	-	*
IA2b6	Other	A6,A9,A11	A2,A4,A6	-	IA2b5[e]

[a] The data in parentheses (66) identify the year the field checking was conducted for the various inventories.
[b] The dash (-) indicates that there was no corresponding cover type mapped for the above inventories.
[c] The asterisk (*) indicates that the cover type for the above inventories is the same as the 1988 standard cover types.
[d] The use of a code, such as the (A) footnoted, indicates that the code used for the above inventory corresponds to the 1988 standard cover types.
[e] The codes that appear in this column are those that are different than the 1988 standard code.

Table 4. Continued.

STATE CODE	COVER TYPES (Standardized in 1988)	UTAH LAKE (66)[1] BEAR R. (69) WEBER R. (70)	UINTAH (67) W. COLO. (67) VIRGIN R.(78) UINTA B. (80)	SALT LAKE COUNTY (82)	U. SEVIER (81) M. SEVIER (83) L. SEVIER (85) BEAR R. (86) WEBER R. (87)
IA3	Forage Crops	-	-	A	*
IA3a	Alfalfa	A1	A10	-	*
IA3b	Grass Hay	A3	A12	-	*
IA3c	Grass/Turf	-	-	-	IA3e
IA3d	Pasture	A2	A13	-	*
IA3e	Other	-	A11	-	IA3c
IA4	Other	-	A18	A1	*
IA4a	Fallow Plowed	-	-	-	*
IA4b	Idle (Overgrown)	A12	A17	-	*
IB	Non-Irrigated	E	B	D	*
IB1	Row & Close-Grown Crops	-	-	-	*
IB1a	Grain (Beans, Seeds)	E1	-	-	*
IB1a1	Wheat	-	B2	-	*
IB1a2	Other Grains	-	B3	-	*
IB1a3	Dry Beans	-	B4	-	*
IB1a4	Safflower	-	-	-	*
IB2	Hayland Crops	-	-	-	*
IB2a	Alfalfa	E2	B1	-	*
IB2b	Pasture	E3	B5	-	*
IB2c	Other	E5	-	-	*
IB3	Other (Plowed)	-	B7	-	*
IB3a	Fallow	E4	B6	Df	*

[1] The data in parentheses (66) identify the year the field checking was conducted for the various inventories.
[2] The dash (-) indicates that there was no corresponding cover type mapped for the above inventories.
[3] The asterisk (*) indicates that the cover type for the above inventories is the same as the 1988 standard cover types.
[4] The use of a code, such as the (A) footnoted, indicates that the code used for the above inventory corresponds to the 1988 standard cover types.
[5] The codes that appear in this column are those that are different than the 1988 standard code.

Table 4. Continued.

STATE CODE	COVER TYPES (Standardized in 1988)	UTAH LAKE (66)[1] BEAR R. (69) WEBER R. (70)	UINTAH (67) W. COLO. (67) VIRGIN R.(78) UINTA B. (80)	SALT LAKE COUNTY (82)	U. SEVIER (81) M. SEVIER (83) L. SEVIER (85) BEAR R. (86) WEBER R. (87)
II	Meadow/Wetlands/Open Water	C	O,F	-	*
IIA	Grassy Aspect	-	-	-	*
IIA1	Irrigated	-	-	-	*
IIA1a	Pasture	-	A14	-	IIA1a1,2a1
IIA1b	Hayland	-	A15	-	IIA1a2,2a2
IIA2	Non-Irrigated	-	-	-	*
IIA2a	Pasture	C4	8,F8	Ws	IIA1b1,2b1
IIA2b	Hayland	-	-	-	IIA1b2,1b2
IIA2c	Non-Agricultural Use	-	-	-	IIA1b3,2b3
IIB	Cattail/Bullrush	C1	F4	Wc	*
IIC	Wet Flats (barren)	-	-	M	*
IID	Shrub Aspect	C5	F2	-	*
IIE	Riparian	C2	-	Wr	*
IIE1	Forested Aspect	-	F1	-	*
IIE2	Shrub Aspect	C3	3,5,6,7,9	-	*
IIF	Open Water	B	E	-	*
IIF1	Streams	-	-	-	*
IIF2	Reservoirs	-	E1,E2	-	*
IIF3	Ponds/Lakes	-	E4	-	*
IIF4	Other	-	E3	-	*
IIF4a	Temporarily Flooded	-	-	-	*
IIF4b	Sewage Lagoon	-	-	-	*
IIF4c	Evaporation Pond	-	-	S	IIFAC,VC2

[1] The data in parentheses (66) identify the year the field checking was conducted for the various inventories.
[2] The dash (-) indicates that there was no corresponding cover type mapped for the above inventories.
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Table 4. Continued.

STATE CODE	COVER TYPES (Standardized in 1988)	UTAH LAKE (66)[1] BEAR R. (69) WEBER R. (70)	UINTAH (67) W. COLO. (67) VIRGIN R.(78) UINTA B. (80)	SALT LAKE COUNTY (82)	U. SEVIER (81) M. SEVIER (83) L. SEVIER (85) BEAR R (86) WEBER R. (87)
III	Range & Forest Land	-	-	-	*
IIIA	Alpine Plants	-	-	-	*
IIIB	Conifer	-	-	Uc	*
IIIB1	Douglas/White Fur	-	-	-	*
IIIB2	Ponderosa	-	-	-	*
IIIB3	Fir/Spruce	-	-	-	*
IIIB4	Lodgepole Pine	-	-	-	*
IIIB5	Pinyon-Juniper	-	-	-	*
IIIB6	Etc.	-	-	-	*
IIIC	Deciduous	-	-	Ud	*
IIIC1	Aspen	-	-	-	*
IIIC2	Mountain Brush	-	-	-	*
IIIC3	Etc.	-	-	-	*
IIID	Grass Aspect	-	-	-	*
IIID1	Dry Pasture	-	-	-	*
IIID2	Native Grasses	-	-	Ug	*
IIID3	Etc.	-	-	-	*
IIIE	Shrub Aspect	-	-	-	*
IIIE1	Northern Desert Shrub	-	-	Um	*
IIIE1a	Sagebrush	-	-	-	*
IIIE1b	Etc.	-	-	-	*
IIIE2	Southern Desert Shrub	-	-	-	*
IIIE2a	Creosote Bush	-	-	-	*
IIIE2b	Etc.	-	-	-	*
IIIE3	Salt Desert Shrub	-	-	-	*
IIIE3a	Shadescale	-	-	-	*
IIIE3b	Greasewood	-	-	-	*
IIIE3c	Saltbrush	-	-	-	*
IIIE3d	Desert Molley	-	-	-	*
IIIE3e	Etc.	-	-	-	*

[1] The data in parentheses (66) identify the year the field checking was conducted for the various inventories.
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STATE CODE	COVER TYPES (Standardized in 1988)	UTAH LAKE (66)[1] BEAR R. (69) WEBER R. (70)	UINTAH (67) W. COLO. (67) VIRGIN R.(78) UINTA B. (80)	SALT LAKE COUNTY (82)	U. SEVIER (81) M. SEVIER (83) L. SEVIER (85) BEAR R. (86) WEBER R. (87)
IV	Barren Lands	-	-	-	*
IVA	Bare Soil/Sand	-	-	-	*
IVA1	Dry Salt Flats	-	-	-	*
IVA2	Beaches	-	-	-	*
IVA3	Other Sandy Areas	-	-	-	*
IVA4	Other	-	-	-	*
IVB	Rock Outcrop	-	-	Ur	*
IVC	Excavated Land	-	-	E	*
IVD	Other	-	-	-	*
V	Built-Up Land	D	C	-	*
VA	Farmstead	-	-	-	*
VA1	Builds/Homes	-	C1,C5	-	*
VA2	Open Spaces	-	C4	-	*
VB	Residential	-	-	-	*
VB1	High Density	-	C3	Rt,R	VB1,VB2,VB6a
VB2	Low Density	-	-	Rl	VB3
VB3	Open Spaces	-	C2	L	VB4
VB4	Idle	-	-	-	*
VC	Commercial/Industrial	F	D	C	*
VC1	Commercial	-	-	-	*
VC2	Industrial	-	-	-	VC4
VC3	Open Spaces	-	-	X	*
VD	Transportation & Utilities	-	-	D	VD,VE
VE	Other	-	-	-	*

[1] The data in parentheses (66) identify the year the field checking was conducted for the various inventories.
[2] The dash (-) indicates that there was no corresponding cover type mapped for the above inventories.
[3] The asterisk (*) indicates that the cover type for the above inventories is the same as the 1988 standard cover types.
[4] The use of a code, such as the (A) footnoted, indicates that the code used for the above inventory corresponds to the 1988 standard cover types.
[5] The codes that appear in this column are those that are different than the 1988 standard code.

APPENDIXES

APPENDIX A

Hydrologic Inventories

Utah Lake Drainage Area. In cooperation with Utah State University. November 1969. 136 pages - includes substantial climatic, streamflow and groundwater data, detailed water budgets and more general information on water quality, geology, economy, history and physiography.

Uintah Study Unit. In cooperation with Utah State University. March 1970. 181 pages - includes substantial climatic, streamflow and groundwater data, detailed water budgets and more general information on topography, geology, arable lands, history, economy, water quality and water development and management. (out of print, file copy only)

Weber River Study Unit. In cooperation with Utah State University. August 1970 - includes substantial climatic, streamflow and groundwater data, detailed water budgets and more general information on topography, geology, economy and water quality.

Great Salt Lake Desert Area. In cooperation with Utah State University. November 1971. 70 pages - includes substantial climatic and water resources data, water budget for Tooele Valley and more general information on physiography, economy, geology and water management aspects.

Bear River Study Unit. In cooperation with Utah State University. February 1973. 126 pages - includes substantial climatic, streamflow and groundwater data, detailed water budgets and more general information on water quality, topography, geology and economy.

Price River Study Unit. June 1975. Includes climatic, streamflow and groundwater data, detailed water budgets and more general information on water quality, topography, geology and economy.

Escalante River Study Unit. December 1976. Includes climatic, streamflow and groundwater data, detailed water budgets and more general information on water quality, topography, geology and economy.

Dirty Devil River Study Unit. January 1977. Includes climatic, streamflow and groundwater data, detailed water budgets and more general information on water quality, topography, geology and economy.

San Rafael River Study Unit. January 1977. Includes climatic, streamflow and groundwater data, detailed water budgets and more general information on water quality, topography, geology and economy.

Update of the Price River Study Unit. June 1978. Includes updated climatic, streamflow and water use data and detailed water budgets.

Update of the San Rafael River Study Unit. December 1979. Includes updated climatic, streamflow and groundwater data, detailed water budgets and more general information on water quality, topography, geology and economy.

Virgin and Kanab Study Units (Utah's Lower Colorado River Area). February 1983. Includes climatic, streamflow and groundwater data, detailed water budgets and more general information on water quality, topography, geology and economy.

Hydrologic Inventory of Colorado, Dolores and San Juan Study Units. September 1987. Includes climatic, streamflow and groundwater data, detailed water budgets and more general information on water quality, topography, geology and economy.

Hydrologic Inventory of the Sevier River Basin. January 1991. Includes climatic, streamflow and groundwater data, detailed water budgets and more general information on water quality, topography, geology and economy.

APPENDIX B

In late 1984, at the beginning of the Division of Water Resource's new phase of mapping water-related land use, an Active Mappers Committee was formed. The Division of Water Resources, Department of Natural Resources and The Division of Agriculture Development and Conservation, Department of Agriculture, co-chaired this committee. Lloyd Austin, Division of Water Resources, and Jim Christensen, Department of Agriculture, filled these roles. Member agencies were:

Automated Geographic Reference
Bureau of Land Management
Bureau of Reclamation
Center of Remote Sensing, University of Utah
Dept of Transportation
Dept of Agriculture
Dept of Natural Resource
Dept of Health - Water Pollution
Div of Water Resources
Div of Water Rights
Div of Wildlife Resource
Soil Conservation Service
State Lands and Forestry
Utah Geological and Mineral Survey
U.S. Fish and Wildlife
U.S. Forest Service/Ogden
U.S. Forest Service
U.S. Geological Service
Utah State University-Extension Service

The committee surveyed all ongoing mapping efforts and then focused on the issue of coordinating and standardizing map data. The relationships between several state agencies and the AGRC program of the Office of Planning and Budget were also clarified. Three specific products came from this committee's work. The first was a standardized definition of a base resource data map file as follows:

Layers of Data	Level of Detail
Infrastructure & Base	Map Quad Sheet (USGS Topo) 1:24,000 scale
Ownership	Federal/State/Private, input 1:250,000 scale
Soils	Level 3 definition with preferred input of 1:24,000 scale
Land Cover	Use standard legend and set preferred input 1:24,000 scale
Climate	Precipitation/Temperature 1:250,000 input scale

Secondly, a standard legend for a cover map was developed and agreed upon which allows a hierarchy of data entry. This is shown as Table 1. The headings which are marked with an asterisk were minimum required for the base data set. Individual agencies could use finer breakdowns as needed for their specific programs.

The Division of Water Resources used only certain categories in mapping the Kanab Creek/Virgin River Study Unit which were considered necessary for water use budgets being prepared. All rangeland and forestland categories were left off while some categories were subdivided further than required by the base data set standards.

The third agreement reached by the committee was the use of a standard set of watershed units for the state. It was agreed that the maps developed by the United States Geological Survey working with National Water Resources Council would serve as the base standard. Individual agencies could then further subdivide these larger units for specific study purposes. This proposal was also presented to the Resource Development Coordinating Committee during the year 1986 and ratified.

APPENDIX C

Water-Related Land Use Studies

Utah Lake Drainage Area. In cooperation with Utah State University. February 1968 - detailed water-related land use tables and maps.

Bear River Drainage Area. In cooperation with Utah State University. April 1969 - detailed water-related land use tables and maps.

Weber River Drainage Area. In cooperation with Utah State University. February 1970 - detailed water-related land use tables and maps.

Uinta Hydrologic Area. Staff Report No. 7. September 1971 - detailed water-related land use tables and maps.

West Colorado Hydrologic Area. Staff Report No. 8. January 1972 - detailed water-related land use tables and maps.

Uintah Basin. In cooperation with U.S. Soil Conservation Services and National Aeronautics and Space Administration. 1980. Contains detailed water-related land use maps and tables. Investigates the use of landsat data concurrently with the high altitude color infrared photography to update the changing patterns of land use. Performed under contract with the Center for Remote Sensing and Cartography of the University of Utah Research Institute. 109 pages plus maps.

Sevier River Basin (Upper Portion), 1981. Contains detailed water-related land use maps and tables. Performed under contract with the Center for Remote Sensing and Cartography of the University of Utah Research Institute. 27 pages plus maps.

Sevier River Basin (Lower Portion), 1985. Contains detailed water-related land use maps and tables.

Salt Lake County, 1982. Contains detailed water related land use maps and tables. Performed under contract with the Center for Remote Sensing and Cartography of the University of Utah Research Institute. 24 pages plus maps.

Sevier River Basin (Middle Portion), 1984. Contains detailed water-related land use maps and tables. Performed under contract with the Center for Remote Sensing and Cartography of the University of Utah Research Institute. 34 pages plus maps.

Virgin River Area, 1989. Contains detailed water-related land use maps and tables. Performed in coopration iwth USDA Soil Conservation Service, St. George, Utah office and Utah Division of Water Rights, Cedar City Area Office. 56 pages plus maps.

Bear River Basin, 1991. Contains detailed water-related land use maps and tables. Performed in cooperation with Utah Division of Water Rights. 50 pages plus maps.

Columbia River Basin (Utah portion), 1991. Contains detailed water-related land use maps and tables. 46 pages plus maps.

Southeast Colorado Basin (Utah Portion), 1991. Contains detailed water-related land use maps and tables. 57 pages plus maps.

Sevier River Basin, 1992. Contains detailed water-related land use maps and tables. 136 pages plus maps.

Weber River Area, 1992. Contains detailed water-related land use maps and tables. 56 pages plus maps.